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EBRUARY 19, 1940
OLUME 29, No. 4

AMERICAN DYESTUFF REPORTER

ICIAL PUBLICATION
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AMERICAN
DYESTUFF REPORTER

VOLUME 29 FEBRUARY 19, 1940 NUMBER 4

Testing the Stiffness

of Yarns and Twines*

DONALD C. SCOTT

THE amount of stiffness or flexibility in a yarn or twine usually accounts for much of its behavior in fabrication and usage. Stiffness of filling yarn certainly shows up in weaving as does wiriness of thread in stitching. In finished fabric the feel or "handle" of the fabric is very often determined by the flexibility of the yarns used in making it.

Numerous factors control the degree of stiffness. Probably the most obvious factor is the size or bulk of the yarn or thread, while others just as important are twist, moisture content, chemical applications such as starch, carbonizing, and tendering with high temperature drying.

From the time when the first yarn was spun, up to the present day, experienced fingers have been able to tell fairly accurately the relative stiffness of yarns and twines. No instrument is made which can compare two threads for stiffness or wiriness as rapidly as experienced fingers; however, there are serious limitations to this art. The most important is that no very definite records can be kept. Then there is the old story of getting two people to agree, or even of getting one person to agree with his own ratings of different days. It naturally follows that a method for evaluating accurately the stiffness of yarns and twines would be of some use wherever this question arises. For example: In making a study of various percent loadings of warp sizing material, if the relative stiffness of each sample was measured, a much clearer picture would result, and the selection of the proper sample would be more accurately carried out.

The rigidity of yarns and twines may be classified as flexural and torsional. Or in other words the stiffness of a yarn or twine is shown by its resistance to bending and twisting. In most cases it is the stiffness of bending that is important, and this paper will be confined to that.

In strength of materials, stiffness is measured as the ratio of the increment of unit stress to increment of unit deformation within the elastic limit. Essentially the same properties are measured for yarns and twines. The sample is distorted a measurable distance with a known force, and the ratio of the force to the elongation is the measure of stiffness.

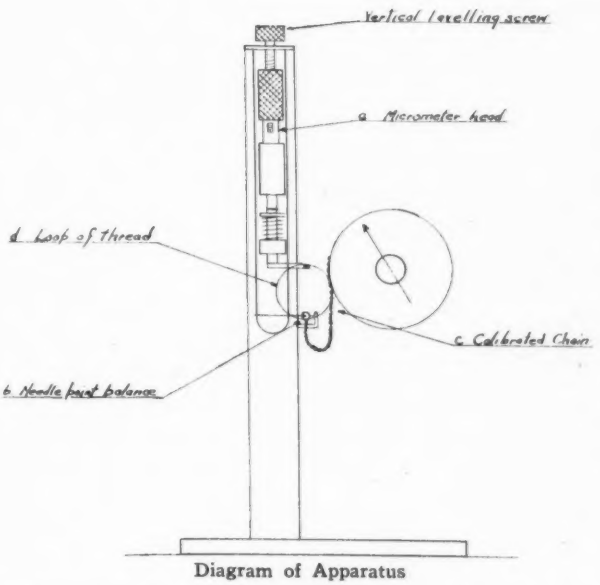

Diagram of Apparatus

Numerous methods of deflecting yarn samples have been tried as pointed out by Schwarz who has made an extensive bibliography. Among these methods are the simple beam supported at the ends, the cantilever beam, horizontal loop as a cantilever, loop set in ballistic pendulum, and the hanging pear, heart and ring loops. Peirce in his paper suggests that for yarns the ring shaped loop probably holds the most promise.

For a yarn and twine stiffness test which may be easily and accurately carried out, the circular loop actually does seem to be the simplest to work with. The loop is made by carefully tying the sample piece around a tapered wooden tube at the required diameter. The ends are fastened with a square knot and clipped as short as

*Contributed for presentation at the Annual Meeting of The American Society of Mechanical Engineers, Philadelphia, Pa., December 4-8, 1939. Statements and opinions advanced in papers are to be understood as individual expressions of their authors, and not those of the Society.

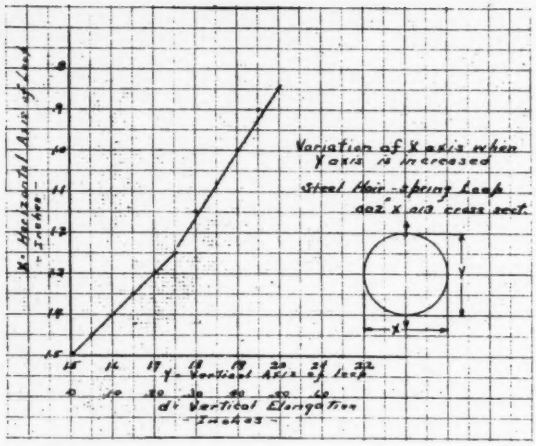
Variation of X axis when Y axis is increased
Steel Hair-spring Loop
.002 X .013 cross sect.
Y
X
Y- Vertical Axis of Loop
d- Vertical Elongation Inches

Fig. 1

possible. The ring may then be slipped off the tapered tube and set in the tester. The tester consists essentially of a deflection measuring device, a needle point balance, and a calibrated chain which may be unwound from a dial thereby loading the loop with small increments of weight.

Elastic Theory of Loop

The loop diameter adopted was 1½ inches. This, of course, may be changed to 1 inch for fine yarns and 2 inches or over for heavy cords. In order to have a standard loop to work from, a steel hair spring .002 x .013 inches cross section was formed into a 1½ inch diameter ring. This ring was then distorted by opposite forces on a diameter Y and a curve (Fig. 1) made from the Y and X dimensions. The curve indicates that the X diameter varies uniformly as the Y diameter is lengthened up to the point where Y has increased to about 1.70 inches.

The following formula[1] gives the elongation of a ring when distorted by two diametrically equal and opposite forces.

$$d = \frac{W\ X^3}{K}$$

where d is elongation in inches
W is weight in grains
X is horizontal diameter of loop in inches
K is constant for elasticity etc.

The same steel ring was then set in the testing machine and stressed from 0 to 10 grains load. Fig. 2 shows weight vs. elongation. The elongation is proportional to the weight applied from 0 to 10 grains. In order to check the experimental figures with the theoretical formula the following table was computed. Data in columns 1 and 2 are from experiment Fig. 2 and data in columns 3, 4, 5, are from experiment Fig. 1. Using the experimental data

[1]Professor Horace Lamb in his, *Flexure and Vibration of a Curved Bar*, and A. E. H. Love in his, *Treatise on the Mathematical Theory of Elasticity*, both take up the circular loop problem to great extent. Love's final equation for deflection may be simplified by omitting some mathematical precision to get $d = \frac{W\ X^3}{K}$. This formula is essentially the same as that for a weightless cantilever beam loaded at the end. Mark's Handbook gives this beam formula as $d = \frac{W\ X^3}{K}$.

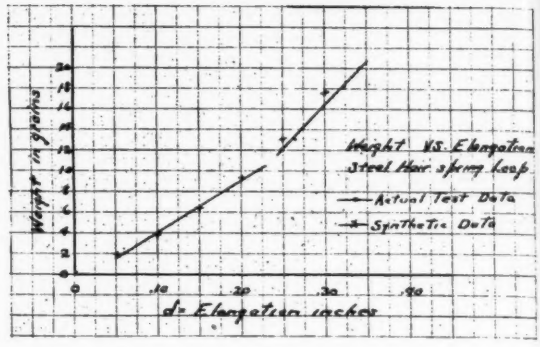

Fig. 2

in the formula $d = \frac{W\ X^3}{K}$, K for each deflection was computed, and the average K found.

1 *W* Weight Grains	2 *d* Elongation Inches	3 *Y* Inches	4 *X* Inches	5 $(X)^3$	6 *K*
2	.061	1.561	1.44	2.99	98.0
3	.082	1.582	1.42	2.86	104.5
4	.102	1.602	1.40	2.74	107.4
5	.123	1.623	1.38	2.63	106.8
6	.140	1.640	1.36	2.52	108.0
7	.162	1.662	1.34	2.41	104.1
8	.183	1.683	1.32	2.30	100.4
9	.205	1.705	1.29	2.15	94.4
10	.221	1.721	1.28	2.10	95.0
End of straight line as in Fig. 2				Average K	102.0

By using this average K of 102, solving for W in the formula $W = \frac{d\ K}{X^3}$ and substituting various values of deflection d, we get new values for W and d which may be put on Fig. 2 as a theoretical curve. Fig. 1 gives $X = (1.5 - d)$; therefore, $W = \frac{d\ K}{(1.5-d)^3}$. It may be seen that the theoretical curve follows the experimental curve closely, within the limits between d = 0.1 and 0.2 inches.

Therefore in dealing with the steel spring loop, if we take the slope of Fig. 2 between 0.1 and 0.2 inches elongation, we will be safely within the limits where the elongation is proportional to weight.

Application of Theory to Practice

In Fig. 3 two twines are shown. If we take the same limits for elongation that we found for the steel loop, we shall have a safe measurement for an elastic material such as the steel. However, it may be seen from Curve A that twine does not always give a straight line even in our limitations from 0.1 to 0.2 inches. If we get the slope of a straight line between points at approximately .10 and .20 inches deflection, we will have a fairly accurate indication of stiffness. For example in Fig. 3, Curve B which is an actual test, at loop elongation .103 the weight is 12 grains and at elongation .208 inches the weight is 24 grains. The elongations are multiplied by 100 to keep whole numbers and give actual slopes. To find

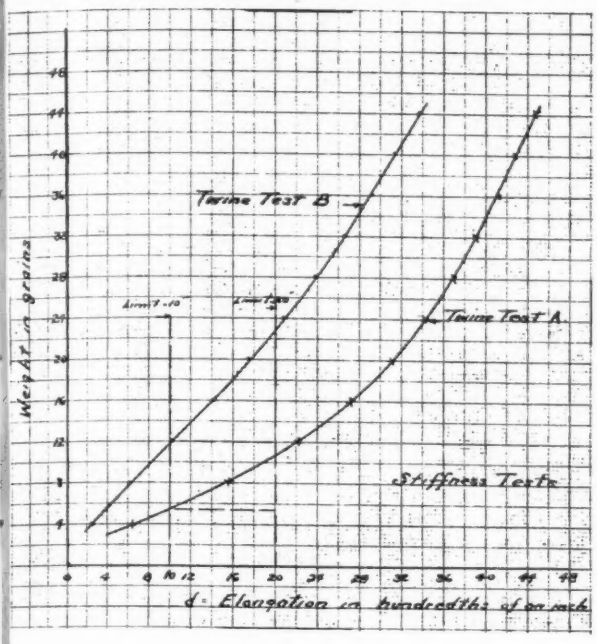

Fig. 3

the slope the point slope formula is used. It is nothing more than

$$S = \frac{24-12}{20.8-10.3} = \frac{12}{10.5} = 1.14$$

This is our stiffness number.

Now in practice we will not bother to make a curve, but will merely set the ring loop in the tester, set the weight and deflection scale at 0 and carry out the following:

Apply initial load of 2 grains which gives .005 inches elongation; wait 30 seconds and set the scale to approximately 0.1 inches; load to a whole number of grains, in this case 12; wait 30 seconds and reset scale exactly to balance point, giving .103 inches elongation.

	12 grains give .103 inches
Repeat for Approx. 0.2 inches	24 grains give .208 inches
Unload to	2 grains give .098 inches

The 30 second time limit is purely arbitrary; it should be at least 30 seconds but can be more. Yarns and twines require time to assume a definite set. By unloading to the initial load another measurement may be made which has not been mentioned before. It gives a test of resilience. Resilience is a measure of the material's ability to come back to its original shape after being distorted and then released. This figure is expressed in percentage with the perfectly elastic steel hair-spring as 100 per cent. The figures in the above example will give:

$$\% \text{ Resilience} = \frac{20.8-09.8}{20.8-00.5} = \frac{11.0}{20.3} = 54\%$$

This measurement while being easily found is probably not quite as useful as the stiffness rating.

In order to give a picture of the practical applications of this test which has been developed some actual test data is given.

Effect of Sizing on Yarn Stiffness

Yarns are often treated with various mixtures or com-

UNSIZED

Weight W	*Elongation d*	*Time Seconds*	*Stiffness S*	*Resilience R*	
0	0				
2	.046	30	.63	55%	$S = \frac{10-4}{20.3-10.7} = \frac{6}{9.6} = .625$
4	.107	30			
10	.203	30			$R = \frac{20.3-11.7}{20.3-4.6} = \frac{8.6}{15.7} = 55\%$
2	.117	30			
0	0				
2	.043	30	.55	67%	$S = \frac{10-5}{20.2-11.1} = \frac{5}{9.1} = .55$
5	.111	30			
10	.202	30			$R = \frac{20.2-9.5}{20.2-4.3} = \frac{10.7}{15.9} = 67\%$
2	.095	30			

SIZED

Weight W	*Elongation d*	*Time Seconds*	*Stiffness S*	*Resilience R*	
0	0				
2	.015	30			$S = \frac{50-21}{21.2-10.7} = \frac{29}{10.5} = 2.76$
21	.107	30	2.76	66%	
50	.212	30			$R = \frac{21.2-8.2}{21.2-1.5} = \frac{13.0}{19.7} = 66\%$
2	.082	30			
0	0				
2	.003	30			$S = \frac{64-33}{22.8-11.2} = \frac{31}{11.6} = 2.67$
33	.112	30	2.67	68%	
64	.228	30			$R = \frac{22.8-7.5}{22.8-.3} = \frac{15.3}{22.5} = 68\%$
2	.075	30			

pounds. In this case several tests were made on the particular yarn before treatment. The yarn was then run through a sizing tank and stiffness tests were made on the new sample. The tests show a large increase in stiffness and a small change if any in resilience. Carrying out these tests along with various changes in per cent loading and different sizing compounds should give enlightening information as to the effect of the different treatments. (See data presented in table on preceding page.)

Drying Temperature vs. Stiffness

The number of tests made here are not nearly enough from which to draw any positive conclusions. They do however show a possible trend toward yarn stiffness caused by high drying temperatures. The samples were all conditioned at 72° F. and 65 per cent R. H. before testing for stiffness.

Temperature 100° F.		*Temperature* 140° F.		*Temperature* 200° F.	
Stiffness Number	*Resilience*	*Stiffness Number*	*Resilience*	*Stiffness Number*	*Resilience*
0.98	61%	1.08	64%	1.10	66%
0.87	64%	1.02	65%	1.02	67%
0.79	53%	1.10	69%	0.86	65%
0.77	60%	1.11	65%	1.20	65%
0.93	64%	0.99	66%	1.18	65%
Average:					
0.87	60%	1.06	66%	1.07	66%

Twist vs. Stiffness

Following are a few tests which indicate the effect twist has on yarn stiffness. The yarns are both the same weight but of a different twist. A longer and more accurate survey of the subject would undoubtedly bring out interesting facts as to the effect of twist on stiffness especially in the case of plys where numerous combinations are available.

2.56 *Turns Per Inch*		4.38 *Turns Per Inch*	
Stiffness Number	*Resilience*	*Stiffness Number*	*Resilience*
0.90	57%	1.43	55%
0.88	53%	1.23	43%

Per Cent Regain vs. Stiffness

Increase in moisture content or regain usually makes for a softer and more pliable yarn or fabric. A few tests were run in order to check this theory with the tester. The results show what effect humidifiers have on yarn wiriness.

5.3 *Per Cent Regain*		12.1 *Per Cent Regain*	
Stiffness Number	*Resilience*	*Stiffness Number*	*Resilience*
1.00	60%	0.52	39%
1.03	64%	0.55	42%

These examples that have just been shown indicate that the tests for stiffness and resilience have a practical purpose. They give exact numerical results which can be kept indefinitely, as against the questionable method of selection by human hands.

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Colorcade

WM. D. BAIRD

THIS narrative has for its genesis a gray September morning back in 1910. In addition to rain clouds, the morning, to at least one individual, was overcast with great clouds of anxiety and with only a tiny speck of silvery hope shining through here and there. Perhaps somewhere he had heard those encouraging words, "Doubts and fears are but shadows which soon pass, etc." At any rate something sustained him as, with two other youngsters, who like himself, were long pants conscious, he waited outside the huge gates of the "BLUE WORKS." All three were there in response to a newspaper ad: "Wanted—One (1)—Laboratory Boy."

Without the aid of "author's convenience" the shadows did pass. He, meaning the writer, got the job. I've often wondered why. Could it have been my earnest young face that attracted the attention of the gentleman who came out to look us over? Or was it only the polished apple appearance produced on it by my mother's yellow laundry soap? I'll never know perhaps, unless the gentleman happens onto these lines, recalls the incident and supplies the answer.

After a prefunctory questioning as to name, address and age I was conducted to the application laboratory where as my first assignment, I was presented with a broom and a pail of wet sawdust. The floor massaging completed, a deep lead lined sink was next indicated. To one side of the sink lay a pile of "dishes." This litter of beakers, dyepots, casseroles, glass rods and bottles was to be cleaned up by first immersing in concentrated sulfuric acid and then flushing well with cold water.

I shall never forget my tutor's very effective effort to impress upon me the necessity for a thorough removal of the acid. After only a partial rinse of one of the beakers I was directed to taste a drop of water from it. The sourness of that acid not only spoiled my lunch for that day, it left a lasting impression in my storehouse of unpleasant memories. Needless to say, as long as that particular job remained as one of my duties, many gallons of water went spilling over the dam---ned beakers.

The laboratory was a spacious affair, equipment ample but the personnel small. The chief was a product of old Germany. He'd had a wide and diversified experience about which he was characteristically vain but his loquacity, intermittent. Another man, younger, but possessed of a natural brilliance and the kid, myself, constituted the laboratory force. The younger man's knowledge was always at my disposal. Upon occasions, not too frequent, a single question put to the chief would start a flow of instructive advice that defied staunching; and then, as suddenly, it would stop. From these men was laid a foundation of learning not to be found in text-books nor yet to be had at evening classes of the local School of Technology.

As one of the pioneers in the American dyestuff industry, the plant had become an institution in the thriving town which harbored its buildings. Some of these buildings which housed the Ultramarine Blue departments were at times externally coated with light deposits of the blue powder; hence the sobriquet—"BLUE WORKS" and to many there was no other name.

In those pre-World War days when the consuming industries of our country depended upon Europe for 90 per cent of their dyestuffs, the "Blue Works" was, with the aid of foreign intermediates, contributing as its share of the balance such colors as Bismarck Brown, Chrysoidines, yellow and red shades, Phosphines, Methyl Violet and Fuchsine among the basic colors. Among the acid colors and phthalic anhydrides were Orange II, Amaranth, Ponceau, Soluble Blues, Alkali Blues, Nigrosines, Eosines and Erythrosines. Also a few oil soluble colors and of course, Ultramarine Blue, many tons of it. Then, too, importations, some from Switzerland but mostly from Germany were necessary in order to offer as full a line as was called for by the paper, leather and textile manufacturers whose business the firm enjoyed.

As might easily be understood, the men who handled these dyes in their manufacture and blending, came to look, in the course of a day's work, like anything but white beings. Their hair, skin and clothing offered to the eye as wide a range of hues as could be found in the spectrum. Indeed, to the writer and other boys at the plant, these vari-colored men were a source of wonder and keen amusement. To us they were "Easter Eggs" in shoes. However, with the passing of time and in the natural process of things, I came to know some of these workers as men of excellent character, of vital importance to the industry, and certainly more highly respected by their employers, than were the silly kids who would at their expense, and at a safe distance, give vent to a stupid sense of humor.

In the laboratory, the wonders in colors that were wrought daily before my very eyes, some aided by my own hands, were as miracles performed by some unseen Wizard of Oz. Little skeins of wool would first be colored a bright red and then by some mysterious means would suddenly begin to develop into a dark blue. And again, yellow cotton immersed in a colorless solution would be lifted out as a bright red. Small squares of leather tumbled over and over in fruit jars all the while taking on various and sundry colors. Pieces of white blotting paper cut like pairs of pants with wide, brightly colored cuffs were all about, and hundreds of small oblongs of rather course, various-hued paper which started out as jars of messy looking pulp. It was all so strangely mystifying to a novice. But, slowly, with the conversion of weeks into months and aided and abetted by older and wiser heads, this wonderland of color seemed to lose some of its glittering mysticism as fantasies began registering as facts.

The "Old Geezer," a name by which the chief was sometimes spoken of, but never to, would sometimes delve deeply into the history of color application when the mood to impart information came over him. And to listen intently was to act wisely. What he told in installments might be condensed and summarized thus:

"What has developed into the dyestuff industry of today was given birth when in 1856, William Henry Perkin, an English chemist in quest of synthetic quinine, quite by accident produced the first coal-tar dyestuff which he named Mauve. Prior to the advancement of Perkin's discovery, the appeasement of man's desire for colored apparel was entirely accomplished by means of natural sources. And it may be assumed without fear of contradiction that the variety of hues thus produced was quite limited.

"From the vegetable sources came Logwood, product of the tropically grown Campeachy Wood, one of the oldest natural dyes from which was and still is produced rich, bloomy blacks. Modern chemistry still seeks to successfully parallel it synthetically. Of almost equal importance among the vegetable dyes was Indigo, the blue derived from the retting of the Indigo or Woad plant of India. This, incidentally, was the forerunner of the vat class of dyestuffs. And still another from the vegetable sources was Alizarine, derived from the madder root and from which was produced the famous Turkey Red. Others, of perhaps not so great importance were Fustic, Archil, Cudbear and Persian Berries.

"History does not record much regarding the mineral sources of color, yet it may be safely assumed that such origination contributed a goodly share before the era of synthesis. Shades of gray and tan or brown were the chief mineral offerings which were produced within and upon the fiber by precipitation. Iron was the chief factor and light fastness the principal result sought.

"When thinking in terms of animal sources, the color

Scarlet immediately brings to mind the Cochineal Bug. The Spaniards are said to have first used Cochineal as a dye upon reaching Mexico early in the sixteenth century. This was believed by many to have been the very origin of scarlet or red from animal sources. It seems, however, that Cochineal was preceded by many centuries as a source of color. Historians point out that even before the Christian Era the ancients of the East obtained a red dye from a worm-like plant parasite known as Kermes. With it was dyed wool, leather and silk. It is also said to have had medicinal value as a heart stimulant.

"Many words have been strung together in telling and retelling the story of imperial Tyrian Purple. This highly famed Purple of Kings was extracted at great cost from the mucous of a shell-fish known as the Murex. Several species were obtainable from various parts of the world but the Mediterranean Sea it seems, provided the finest quality. Shortly after the turn of the twentieth century a Viennese sought to produce the color synthetically. In his investigations, he is said to have used more than ten thousand of these marine creatures which yielded something less than two grams of the pure purple. Success finally crowned his efforts when in 1909 he produced it as a dibromindigo. It was undoubtedly a great source of satisfaction to uncover the secret which was held for so many centuries by the lowly Murex but its importance soon faded. Other color compounds were being produced which easily replaced, and at lower cost, every property of the purple.

"The publication of Perkin's discovery, sounding as it did the death knell of natural coloring matter production, seemed to serve as a "Green Light," the GO signal for the rapid development of an industry which was destined to hold an important niche in world affairs. Scarcely had Mauve been introduced commercially than the basic color Fuchsine or Magenta was brought forth. Thereafter quickly followed a group of colors designated as the azo colors; a direct result of the discovery of the so-called diazo compounds in 1858. Next came in quick succession the Soluble Blues, Chrysaniline, from which were derived the Phosphines and others, Bismarck Brown, Chrysoidine, Methylene Blue, groups of substantive or direct and developed or diazo colors and others seemingly without end. And, too, synthetically produced Alizarine, the discovery of Indanthrene and the production of the sulfur series made possible groups of dyes possessing fastness and other properties priorly unknown. Within less than forty years of Perkin's accidental contribution, the synthetic dye industry had grown to voluminous proportions." —And now, ironically, despite its British origin, this vast business had become predominantly German. (A source of great pride to "Old Geezer.")

In addition to a share of the textile consumers' business, the firm catered largely to the paper and leather trades. As a natural consequence, much of the laboratory work was confined to these two fields. The chief directed much of his attention to the coloring of paper. The younger man, my other mentor, was concerned mainly with coloring and tanning problems submitted by friends in the leather industry.

An important piece of equipment in the laboratory was a paper machine, small but complete in every detail. The machine ran a twelve inch sheet of paper, four pounds to the run. Color card work was the prime purpose of the machine but then, too, it served well for practical checks on shades matched in the hand molds. Our hand mold paper making consisted in weighing a quantity of pulp of predetermined dry weight, bringing to a definite volume with water, and then adding color, rosin-size and alum, or lead acetate as might be required, in the case of sized papers. Unsized papers were merely salted and heated. The colored pulp was then poured into the hand molds, water extracted by means of a vacuum pump and then, after pressing between sheets of filter paper, dried on a steam heated metal plate.

The coloring of paper has something in common with the old mechanical theory of dyeing as applied to textiles; that is, the fixation of color on the pulp fiber is apparently brought about by mechanical adherence rather than chemical union. Generalizing, paper is colored by either or both of two types of coloring matter; the soluble anilines and the pigments or natural mineral colors. The pigments or minerals as a class, offer the best light fastness, and, too, serve as fillers or weighters, two advantages from a selling standpoint. Of the anilines, direct or substantive colors alone have real affinity for the pulp fiber and are aided in this by the application of heat and addition of salt. They are suitable for blotting papers where sizing cannot be employed. Acid colors have no particular affinity and are fixed on the fiber as aluminum lakes. Basic colors do have some affinity, especially for unbleached sulfite and ground wood. For certain desired effects, pigments are sometimes fed into the beater and followed by one of the soluble types. Fillers such as china clay, talc, precipitated chalk, etc., are sometimes used to improve feel and calendered finish. And, too, these fillers exert varying degrees of absorptive power over the acid colors. A clear effluent or back water is to be desired in any case. This is the equivalent of course, to a clear exhaust in the dyeing of textiles and thus is obtained a maximum fastness to water spotting and uniformity of shade.

The preparation of paper pulp is mighty interesting and warrants a few lines here. There are four types of paper pulp or methods of producing it. Briefly they are—sulfite, sulfate, soda and ground wood or mechanical pulp. These are subdivided into bleached, unbleached and kraft pulps. Kraft pulp is produced by the sulfate process and purposely undercooked to make a stronger stock.

Strictly speaking, paper is the vegetable substance, cellulose.

The suitable woods are logged, chipped and then cooked in digestors under pressure.

The sulfite method employs aqueous sulfurous acid to which lime or some base has been added. Caustic soda

(Continued on page 95)

PROCEEDINGS OF THE
American Association of Textile Chemists and Colorists

FEBRUARY 19, 1940

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Members should notify the **Secretary** immediately of all address changes

• CALENDAR • OF COMING EVENTS

Meeting, New York Section, Swiss Chalet, Rochelle Park, N. J., March 1, 1940.

Meeting, Philadelphia Section, Penn A. C., March 8, 1940.

Spring Meeting, Piedmont Section, King Cotton Hotel, Greensboro, N. C., April 27, 1940.

Meetings, Council and Research Committee, National Bureau of Standards, Washington, D. C., April 19, 1940.

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

Quality Control

in a Woolen Mill*

WERNER von BERGEN**

THE present mill processes used in woolen and worsted mills are based on practical experiences which were developed over a period of approximately 150 years. The formulas used in processes such as scouring, oiling, sizing, dyeing and bleaching were established by empirical means. Up to 1920 science had never penetrated very far into the woolen industry to check up the facts of these practical experiences and the correctness of the formulas used.

Laboratories in woolen mills were not considered a necessity. Before 1914 there were only a few far-sighted mills who had laboratories, and their work was chiefly confined to the dyeing department. In trying to dig into the history of some of the laboratories, Mr. Morrison, chief chemist of the American Woolen Company, gave me the following interesting points:

According to Mr. Claflin, who terms himself as one of the old Indians still left in the chemical and dyestuff business, Eli Forbes, who graduated from M. I. T. in 1868 was probably the first American textile chemist. He was in charge of the chemical department at the Lancaster Mills in Clinton, Mass., an old gingham mill which is now extinct.

In 1876, Louis Mills Norton, also a graduate of M. I. T., established the Chemical Department in the Amoskeag Mills in Manchester, N. H. In the woolen industry John Alden, graduate of the 1877 class of M. I. T., was chief chemist of the Pacific Mills.

When the American Woolen Company was formed in 1899, W. D. Livermore who was chemist for ten years at the Washington Mills, one of the units about which the company was formed, was made chief chemist and the laboratory was maintained at the Washington Mills. Mr. Livermore graduated from M. I. T. in 1887 and was for a couple of years with the Silver Spring Dyeing and Bleaching in Pawtucket before coming to the Washington Mills. Around 1890, the Arlington Mill established a laboratory with Mr. William D. Hartshorne in charge. These men were probably the outstanding pioneers in chemical laboratories connected with the textile industry. Even today, in most of the smaller woolen mills, the dyer is the only man who has some chemical training and the use of his knowledge usually is apportioned to the dyeing, bleaching and wool scouring. The situation in European woolen mills is very similar.

The real awakening to the textile chemist came after 1920, when the economic conditions following the war caused manufacturers to seek ways and means of producing their goods at lower cost and with greater efficiency. In doing this they realized the lack of knowledge about their own product and detected the necessity for fundamental wool research.

Did their realization of this need produce any results? Indeed! We can be proud that the strivings which were made in the last 20 years have brought many valuable results. The main properties making up the quality of wool fiber were established on a scientific basis, as well as many of the underlying facts which impair these quality factors during manufacturing.

All the results of this research gathered by industrious research workers, not only in our own country, but all over the world, especially in England and Germany, is available in several books as well as in leading periodicals. It is up to us to make use of it by incorporating the methods in our daily work.

For the purposes of controlling the quality in a woolen mill, the main duty of the laboratory is to supply each department head with the necessary information about the product he is working with. This is done in order to enable him to deliver the product in its highest possible quality of workmanship to the following department.

For example, the worsted spinner must be supplied with information about the scoured wool, the top, roving, and the yarn, in order ot deliver to the weaver the best warp and filling yarn.

What are these essential informations? And how can we determine them? These questions can best be answered by us taking an imaginary trip through the Forstmann Woolen Company's laboratory. During this trip I will only have time to enumerate the highlights, and confine myself to the control of the raw material, wool, as it changes from the raw stage and loose form, into the sliver, top, yarn and fabric. This control work is done by three departments, the chemical, the physical and the optical.

Upon entering the first room, the chemical section (see Fig. 1). we find ourselves in a laboratory room which,

*Presented at meeting, New York Section, December 1, 1939, and meeting, Philadelphia Section, January 19, 1940.

**Director of Research, Forstmann Woolen Co.

Fig. 1—General View of Chemical Department

Fig. 2—Wool Scouring Unit; Opener—Right; Scouring Tubs—Left

at first sight, seems no different from any other. It has a large laboratory table decorated with all kinds of bottles containing the normal chemical solutions, such as acids, alkalies and salts and some equipment for sample dyeings.

As we glance about, we see in one corner of the room, a wool opener and a scouring unit.

RAW WOOL

In all the larger woolen mills, the wool arrives in its raw state as it is shorn from the animals. One of the most difficult tasks the wool industry has to cope with, is the accurate judging of the shrinkage of this raw wool.

The evaluation of a lot of wool is estimated in the trade by experienced wool handlers. They base their judgment on the actual mill shrinkage of similar lots previously delivered to the mills. In recent years more and more occasions have come up where laboratories were called upon to establish the approximate shrinkage to be expected from the lot on the basis of small samples submitted. This was done either to check the estimated shrinkage of samples sent in from the wool merchant, or to give the department head a definite idea regarding the amount of clean wool he may expect from the raw wool which he has on hand, — far in advance of his actual needs, — thus enabling him to make future dispositions.

Until recently most of the attempts to get comparative results with the entire lot when processed at the mills have failed, because of unsatisfactory methods of sampling. In the last two years considerable research was made to develop a standard method for sampling and a standard scouring procedure. This research was undertaken by two government agencies, the Treasury Department, and the Department of Agriculture in collaboration with some mills and the Wool Section of the American Society for Testing Materials.

The equipment you see in Figure 2 was built on the basis of this research, and the working procedure is the one laid down in the A.S.T.M. Standards on Textile Materials of October, 1939, "Proposed Method of Test for Shrinkage of Grease Wool," page 254.

The duty of the opener is to work the sample into a homogeneous mass by three or more passes through it accompanied by as thorough a mixing by hand as possible. From the dusted wool, three test specimens, each weighing about 200 grams are then drawn at random, and scoured in this 4-tub scouring unit.

The procedure is similar to the procedure on the large scale with the only difference that the samples have to be handled with more manual labor. The wool specimens are placed in a basket which is immersed in the scouring liquor to accentuate the scouring effect. The samples are slowly moved by means of wooden paddles from 3-5 minutes. After that, the specimens are removed from the tub, by means of the basket and put through a wringer dropping them into the basket of the next tub. This procedure is repeated four times. The scouring liquor in the first three tubs contain three grams of soda ash, and one gram of neutral flake soap per liter. The fourth tub is a rinser filled only with plain water. The temperature of the bath is kept between 45° and 50° C. The three test specimens of 200 grams are treated successively. The whole procedure takes approximately one hour. The specimens are then extracted and dried to constant weight in a conditioning oven. Where the sampling and scouring is properly done, the percentage yields of the three test specimens should not differ more than 1 per cent.

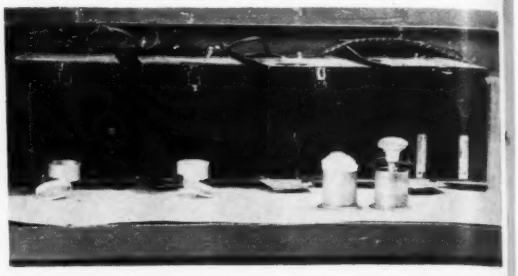
Compared with the actual mill yield, the results obtained by this method over a period of approximately one year is plus or minus 1 per cent. In most instances it is even plus or minus ½ per cent. For example, on a test lot of 301 bags of Montana wool (70,000 lbs.), the following results were obtained:

Mill Yield 271 *Bags*	*Mill Yield* 30 *Bags*	*Laboratory Yield Random Sample from 30 Bags*
43.69%	44.23%	43.86%

SCOURED WOOL

When the scoured wool is delivered to the spinning department, the spinner must have the assurance that he receives a clean product. The wool is considered as properly scoured when it contains less than 1 per cent fat and less than 1 per cent of ash and has a pH below 10.

Fig. 3—Chemical Department Ether Room



Right — Fig. 5 — Instruments used in McKenzie Rapid Methods for Fat Determination in Wool; Metal Cups, Aluminum Container, Greasometer with Plunger.

The fat content has to be considered the most important factor because it is the best indication of the cleanliness. The standard method normally used is the Soxhlet extraction (see Fig. 4), with the help of solvents such as ether or carbon tetrachloride. In a half hour ether extraction 90 per cent of the wool grease is removed and for checking purposes this is sufficiently accurate. For more accurate analyses, the test has to run for 2 to 2½ hours. In using ether, which is highly inflammable, a special room is provided for protective purposes. As this procedure still involves too much time, many laboratories have developed certain short cuts, one of which was published just recently in the AMERICAN DYESTUFF REPORTER.*

The method we are using in the Forstmann Woolen Company laboratory is a method developed originally by McKenzie of the American Chemical Paint Company using metal cups with plungers, aluminum container and a dryer or greasometer. The procedure is as follows:

RAPID METHOD FOR FAT DETERMINATION

Preparation: Clean and weigh the container. Weigh two 5 gram samples from each sample of wool to be tested.

Method: Place one 5 gram sample in the cup and pour in 29 cc. of carbon tetrachloride. Press the wool down hard in the cup with the plunger 10 times, then let it stand one minute. Press down ten more times and let stand for one minute. Now plunge ten times and then hold the cup over the graduate and squeeze till 13 cc. of liquor is in the graduate. Empty the graduate into the container.

For Scoured Wool, Top and Worsted Yarn: Place the container in the greasometer and dry for about three minutes. When dry remove from greasometer, and let cool with cover off for one minute. Put cover on. Now weigh, and from this weight subtract the clean weight of the container.

Divide this difference by 2

If the result is less than.. .30%, add .2%

If the result is between... .30 and .50%, add 20% of the result

If the result is over..... .50%, add 10% of the result

By having ten or more aluminum containers and two to three dryers, fifty or more analyses can be made daily without difficulty. The time for one analysis is approximately ten minutes. The necessary instruments for these tests are illustrated in Figure 5.

Out of the numerous other chemical control tests, I would like to mention the control of the amount of size on warp yarns. For example, we have found that for fine single yarns such as 1/38's and 1/48's, 15 per cent size is needed to insure perfect weaving.

*American Dyestuff Reporter, Oct. 30, 1939.

Fig. 4—Inside of Ether Room; Soxhlet Battery

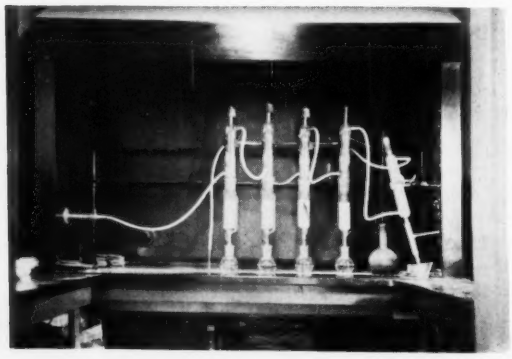
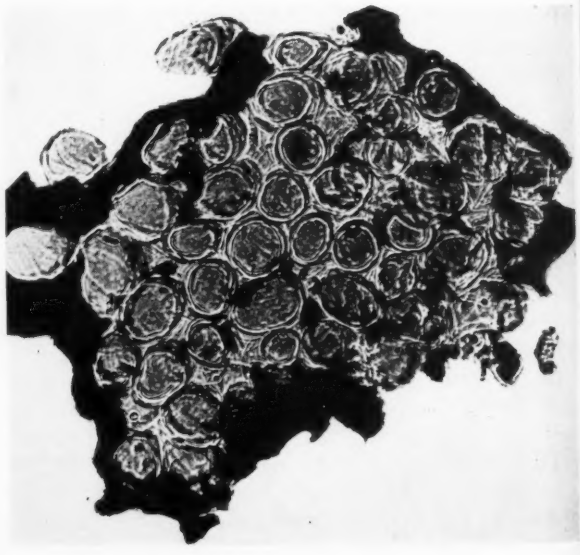


Fig. 6—Cross-Section of Sized Yarn; Starch Colored with Iodine



The photomicrograph illustrates the distribution of the size around a yarn. The test of the amount of acids in carbonized cloth is important because when the percentage of the sulfuric acid exceeds 6 per cent, severe damage may result. The test is developed to such an extent that we furnish the finishing department with the strength of acid for the different styles to insure perfect results. It is only natural that the testing of the dyed materials in any form, — loose, top or piece, — is a major function of the chemical department.

Most of these tests, such as fastness to scouring, fulling, carbonizing, perspiration, light, are too well known to this group, to need further going into. Our association can be proud that most of these methods were developed within our own circle and are published annually in the Year Book.

The testing of the light fastness is probably the field where some remarks are appropriate. The dyestuff companies are mainly concerned about the light fastness of individual colors. The mill, also concerned with this angle, is however, even more concerned regarding fastness properties in the mixtures of the various colors which have to be used to obtain a certain shade. The fastness property of the individual dye may be satisfactory, but in combination with others, they may reveal an entirely different picture.

To make possible the proper rating of the light fastness, our association last year adopted the European scale of rating, which divides the light fastness into eight classes. Class 1 representing the lowest, and 8 representing the highest fastness.

Through the Lowell Textile Institute, the association has four of these standards available, 1, 3, 5 and 8, which can be bought by the trade in the form of small swatches. Our tests have shown that the four swatches are not entirely enough to cover the whole range, and we prefer to use the whole scale of all eight samples which the European dyestuff concerns have available to their customers in small booklet form. We used these in evaluating all our shades for the Winter season 1939, where we rated 95 piece dyed shades with the following result:

Number of Shaded Affected by Sunlight

Total Number of Shades—95

Sun Hours:	16	30	55	80	105
	1	7	35	93	95

Average light fastness for the 95 samples: 5.9 for 105 sun hrs.

This high rating can naturally only be accomplished by using the best available acid dyestuffs. It is interesting to note, that the one sample which showed some fading already after sixteen sun hours, first rated a light fastness of 4, and at the end of the test a light fastness of 6-7. The reason for this peculiar behavior was that the last addition the dyer made to bring the life of this violet shade to the fore, had to use an acid violet with a light fastness rating of only 2 to 3. This addition faded away in the first thirty hours. After that, the much faster ground, which was produced by a violet of the Irisol class, hardly changed.

Fig. 7—Sunlight Testing Frame

The light tester which we use is an old blueprint frame as shown in Figure 7. The samples are protected by a glass cover and to avoid the unnecessary accumulation of heat in the case, holes have been bored to facilitate ventilation.

MOISTURE DETERMINATION

The next room, the conditioning room, which we have now entered, belongs to the physical testing department, and is entirely devoted to the determination of the moisture content of scoured wool, tops and yarns.

As you well know, the amount of moisture in the woolen material is directly affected by the amount of moisture in the surrounding air. For example, the moisture regain of a top at the relative humidity of 43 per cent is approximately 12 per cent, whereas the same top at a relative humidity of 75 per cent is able to regain 16.5 per cent moisture and at 90 per cent relative humidity about 22 per cent. Such large differences occur very easily in mill practice through weather changes from a dry, sunny day, to a rainy day. The mills try to overcome this situation by having the spinning and weaving rooms humidified. The ideal would be to have the entire mill air conditioned, but as this is very expensive, such conditions are only found in brand new mills and then but rarely.

The result of these tests is in one instance used for the calculating basis of the shrinkage of wool to reduce all weight on a common basis of moisture content. In checking the moisture content of the yarns, the worsted spinner is enabled to change his machinery according to the moisture content avoiding either deliveries of yarns to the weaving department with too much moisture, which would mean a loss to the weaving later, or with not enough moisture which would mean a loss for the spinning department.

The principal method for determining the moisture content is the oven method. These ovens are of special construction like the forced draft Emerson conditioning ovens, illustrated in Figure 8. The greatest disadvantage of these ovens is the time necessary to dry a sample.

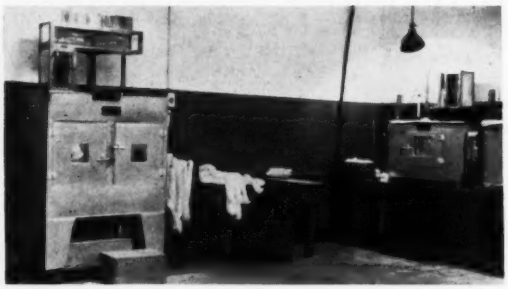


Fig. 8—Conditioning Room; Forced Draft Emerson Conditioning Oven for Loose Wool and Top, Left; Yarn Conditioning Ovens, Right.

Therefore, time and time again, efforts have been made to build instruments to reduce this factor.

Electrical instruments, which permit an instantaneous reading, have, up to now, proven that they are not reliable enough to stand constant use and the more or less rough handling under mill conditions.

Recently Dietert* placed a Moisture Teller on the market which is illustrated in Figure 9. It is a good step forward in solving this problem. As can be seen from the photograph the instrument is simply built on the principle of a hair dryer. The sample is placed on a pan or basket fitting into the lower part of the instrument and by turning on the heat, the draft of hot air rushing through the sample accomplishes perfect drying in a few minutes. Tests made with the instrument gave the following results:

	Material	*Emerson Oven*	*Moisture Teller*
(1) Top	Moisture regain	15.464%	15.478%
	Deviation	±.17%	±.18%
	Drying time	55 min.	8 min.
	Size of sample	170 g.	20 g.
(2) Yarn	Moisture regain....	13.81%	14.52%
	Deviation	±.51%	±.51%
	Drying time	50 min.	7 min.
	Size of sample.....	5 g.	5 g.
(3) Top	Moisture regain	17.58%	17.57%
	Deviation	±.84%	±1.06%
	Drying time	50 min.	7 min.
	Size of sample.....	140 g.	20 g.

In Tests No. 1 and No. 2 the material was laid out for twelve hours in the air conditioning room to equalize the moisture. The number of samples tested was five in both cases.

In Test No. 3, which represents the average of ten tests, the samples were taken directly from the combing room. Each sample consisted of four slivers each two meters long. With the oven test six meters were used, and for the moisture teller test two one-meter tests were run. The result indicates that for control analysis, the moisture teller gives the results quickly and nearly as accurately as the oven.

The drying temperature in the Moisture Teller varied between 220-250° F., whereas the oven temperature was between 210-230° F.

Now we pass through a vestibule into an air conditioned room. It was one of the facts brought about in the research we mentioned earlier, that it clearly demonstrated the necessity of such rooms for physical testing of textiles, especially wool. For example, in correlating the strength of yarn lots previously tested with newly spun lots, this can only be done with justification when the previous tests were made under exactly the same conditions.

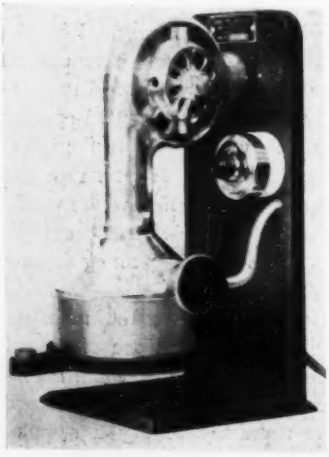
The testing of lengths of top is accomplished with the stapling apparatus as shown in Figure 10.

LENGTH

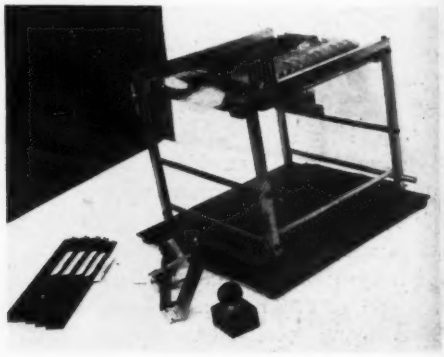
The grandfather method of pulling the wool fiber over the knee to judge the length, is today replaced by methods such as the A.S.T.M. method D 519-38T. In this method, with the help of stapling apparatus, the fibers are segregated into ½" groups and each individual group is measured and weighed separately. On the basis of this a staple diagram can be drawn expressing the distribution of the length.

In using this method, it was found that the condition under which these tests are made has a decisive influence on the average length. When testing under standard conditions (70° C. and 65 per cent R.H.) the average

*Harry W. Dietert Co., Detroit Michigan. General Agency: Alan A. Claflin, Boston, Mass.



Left—Fig. 9—Moisture Teller— *Dietert*



Right—Fig. 10—Wool Fiber Stapling Apparatus— *Suter*

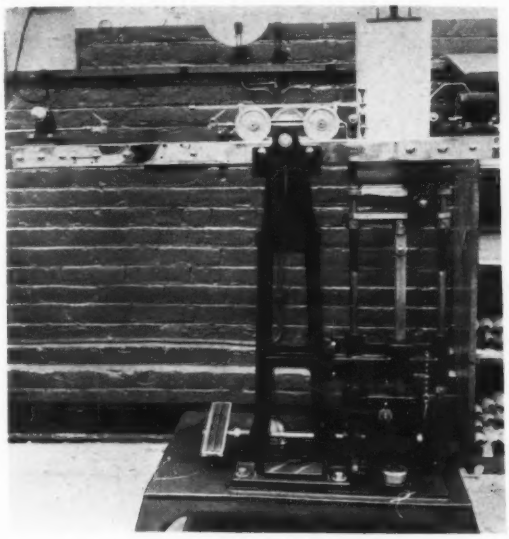


Fig. 11—Incline Plane Single Strand Yarn Tester—*Scott*

length of a top of 14-15 per cent moisture may be from 2-6 per cent higher than top tested under normal room conditions with an average moisture content of the top between 8-10 per cent. The variations in the length is an excellent criterion for the uniformity of the top and reflects the length uniformity of the raw material used. Very good tops show a variation around 30 per cent, average top around 35 per cent, and below average 40 per cent and more.

The results obtained by these tests are used by the superintendent of the worsted spinning department to select the proper top for certain yarns.

Much time is expended in his room to test each yarn lot spun in the mill for the correct size and correct twist. The methods followed are the A.S.T.M. method for woolen and worsted yarns.

Fig. 12 — Tensile Strength Tester for Yarn Skeins and Cloth—*Scott*

The testing of the strength of the individual yarns is done either on machines as shown in Figure 11 of the incline plane principle, for single strand yarns, or on a combination testing machine for yarn in skein form and cloth, as illustrated in Figure 12.

The first machine is made on the principle of a carriage free to move on a plane which can be so inclined that the pull on the specimen is at the uniform and constant rate of load. It applies to the specimen itself a definite amount of load per unit of time, regardless of whether the test sample is long or short, elastic or rigid. After each test it returns to the starting position automatically. A recording mechanism is attached which magnifies the test in the stretch direction, as well as in the load direction.

For comparison, standards have been developed for all the different kinds of yarns, which allows the operator to judge quickly whether a yarn is higher or lower in strength.

The tensile strength tester for yarn in skein form and for cloth, as illustrated in Figure 12, is mainly used to speed up the operation, and is used for similar purposes as the previous machine.

When changing the machine over from skein testing to cloth testing, the two holders for the skein are interchanged with clamps. In testing cloth, the grab and strip methods as designated in theA.S.T.M. standard D 76-37, are used. Here again, certain standard specifications are set which are used as guides.

To test the evenness, cleanliness and neatness of a yarn, the spinner is accustomed to wind from a bobbin enough yarn on a blackboard for visual inspection. The silk industry has developed the seriplane test, which allows winding up to ten spools at the same time in panel form. The inspection boards upon which the yarn panels are wound, are then put in an inspection room especially equipped for this purpose with 2-way illumination. The Forstmann Woolen Company's laboratory has adopted this same method for inspection of woolen and worsted yarns. The inspection room is shown in Figure 13.

By illuminating the seriplane board by a side light from the front, the uneven, heavier and thinner places are readily noticeable to the eye in form of definite stripes. By turning on the vertical illumination from the top, the cleanliness and neatness of a yarn is apparent, as the light

Fig. 13—Inspection Room for Seriplane Yarn Test

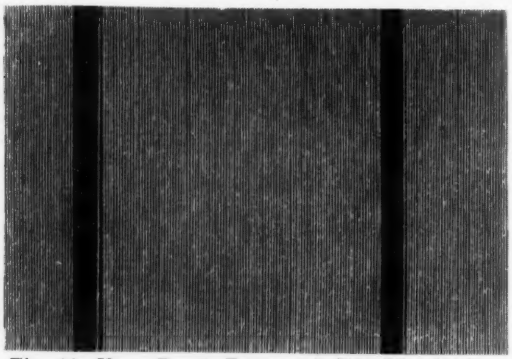


Fig. 14—Yarn Panel, Front and Side Illuminations, 1/28 Worsted Yarn

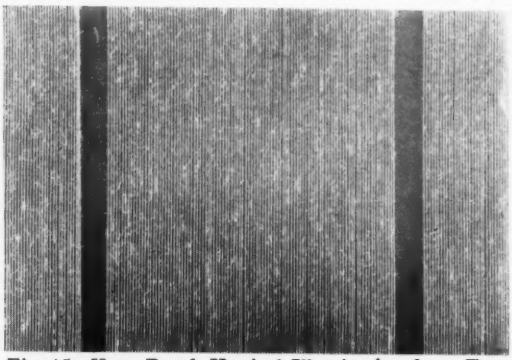


Fig. 15—Yarn Panel, Vertical Illumination from Top, 1/28 Worsted Yarn

brings out the amount of fuzz on the yarn, slubs, nibs and other imperfections.

We have found this method very effective to bring home certain points to the spinner.

The finished fabrics are also controlled in regard to width and weight, and to get an idea of their wearability, they undergo an abrasion test.

OPTICAL DEPARTMENT

The main work-shop of the optical department is the dark room. Figure 17 shows some of the equipment in this dark room for measuring the quality of the wool which influences the finished product far more than anything else, namely the size of the individual fibers or the grade of the wool.

In putting together the proper blends to produce certain yarns, it is most important for the spinner that he has an accurate knowledge about the fineness of the fibers he wants to use.

The determination of this important property is today a daily routine work of the laboratory based on scientific means, eliminating all guesswork which is connected in trying to do this by eye judgment.

Standard Method of Test for Fineness of Wool

The methods used are the methods established by the A.S.T.M. There are two methods chiefly used, namely the width method and the cross-section method.

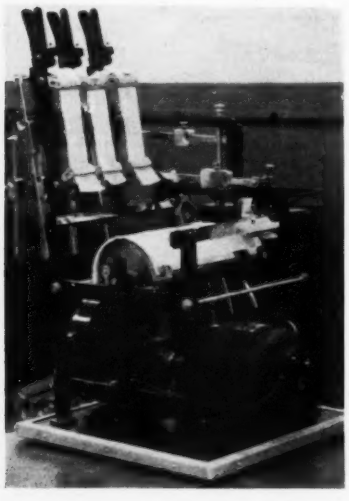
The width method is based on the projection of the image of the fiber at the high magnification through a microscope onto a wedge ruler. The width of the image of the fiber is recorded on the wedge ruler by which the fibers are automatically sorted according to their width.

The Cross Section Method

In this method the image of the fiber cross-section is projected and measured similar to the width method or recorded on photostat paper. The fiber images in this case are measured in two directions, establishing the major and minor diameters.

In a cross-section method, the specimen is mounted in a cross-section device consisting of two parts: a fiber holder with a fiber slot and a slide holder with a middle plunger to fit into the slot of the fiber holder.

The Bausch & Lomb VH Fiber Apparatus mainly used for the work is shown in Figure 17. It is a simple projecting microscope with moveable stage and fixed body tube. This instrument is especially suitable for width measurements and photo recording of cross-sections.



Left—Fig. 16—Abrasion Machine

Below—Fig. 17—Dark Room, Fiber Measuring Instruments; Left, Lanometer—*Zeiss;* Right, V. H. Fiber Measuring Apparatus—*Bausch & Lomb*

Fig. 18—Universal Microscope—*Reichert*

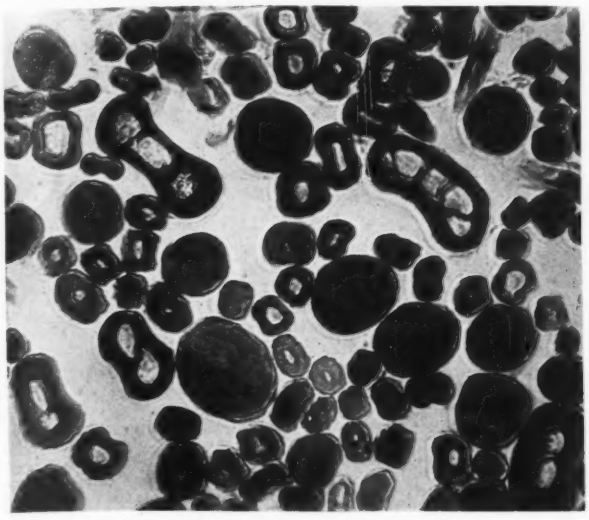


Fig. 19—Cross-Section—Wool-Rabbit Hair Blend

For example, cross-section of wool, rabbit hair blends, are very easily analyzed with this machine.

For the grading work, the mill has set up a standard, and all measurements are rated according to this standard. For example, on a lot of top there is recorded the fineness, length, the fat content and the hairs, burrs, flyers and spots.

CONCLUSION

Now that we have completed our journey, I may say that tests such as the determination of the shrinkage, fat, size, and acid content, control of the light fastness, the moisture determination, controlling of count, twist, strength, abrasion, and the scientific grading of the wool, represent the most important tools to control the quality of the Forstman Woolen Company's cloth.

In addition to its function as a controlling department, the laboratory has also an excellent opportunity in educating the mill force and making it possible to build a bridge between the viewpoint of the practical man and the viewpoint of the scientist.

DISCUSSION

New York Section Meeting

Mr. Blackwood: I understand that there is a minimum amount of grease that should be left in wool after scouring beyond which it is dangerous to go. Can you tell me what this minimum is?

Mr. von Bergen: It depends on your method of spinning. We have found in worsted spinning you can go as low as .3 per cent. You actually have to go as low, at least, as .75 per cent to insure proper running, no matter how much theory there is that the best amount is about one and a half per cent. When you leave one and a half per cent of grease in worsted wools, it just doesn't run in the drawing equipment.

For woolen yarns, you can leave one and a half per cent grease in and still have a good working product, but the best amount is around one per cent.

Mr. Levine: Could you tell me, on a 64's top, what the minimum of fibers is that should be used to get an accurate determination?

Mr. von Bergen: 600.

Mr. Kapelsohn: I wonder to what extent you have been able to develop these methods of arriving at serviceability standards on the finished goods. For instance, you mentioned the fading tests in which you use the natural sunlight rather than the Fade-Ometer. Do you have any number of hours below which you will not pass a dyed piece of finished goods?

Mr. von Bergen: We have none. That is one of the things still to be explored thoroughly. The only thing we do is to collect the claims from our customers and study and compare them with the actual result.

You may have a color which shows quite poorly, but you may never get a claim. You may have a color which rates very high and it gets to one person who is very particular and feels she paid enough for the Forstmann woolen cloth so that she should get service from it, and she puts in a claim.

Mr. Kapelsohn: One of the reasons I brought up the question was that we have found—being in the retail end and getting the kicks first hand—that there are many particular types of colors, for instance, the newer greens and blue greens that some of the men began to fall for, which are especially bad on fading, and yet the various mills will turn out almost anything that matches those colors. Some of them fade very rapidly and there is no question about customers being correct when they complain about them. That is why I wonder how far the mills might go in setting up their own standards.

Mr. von Bergen: That is up to the dyestuff manufacturers.

Mr. Herrmann: You mentioned six per cent of sulfuric acid left in carbonized material. Does that require some special compensation dyeing?

Mr. von Bergen: No.

Mr. Herrmann: You simply have to select dyestuffs that will level under those conditions?

Mr. von Bergen: The six per cent is the amount of acid in the cloth during the burning stage. After that the pieces are neutralized.

Mr. Herrmann: I see. That isn't a residue that stays in the finished goods?

Mr. von Bergen: That doesn't stay in the cloth, except during the carbonizing process.

Mr. Herrmann: That is neutralized afterward?

Mr. von Bergen: Yes. But many mills do store these pieces full of acid and dye them later in this state.

Mr. Herrmann: That is what I was thinking.

Dr. Dannerth: To what extent is the American wool supply adequate for our needs? Is it necessary for us to

depend on wools that are grown outside of United States territory?

Mr. von Bergen: Yes, it is. We import annually approximately 250,000,000 pounds from foreign countries. The bulk of it is used in the carpet trades. The material industry does not suffer so much now as the carpet industry does. However, in good times, the apparel industry, mills such as ours, imports from 20,000,000 to 50,000,000 pounds annually.

Our country does not produce enough wool to take care of the needs in normal times. In times like these, naturally the demand for woolen cloth is increasing by the Army and Navy Departments.

Dr. Dannerth: Leaving out of account the wools required for the carpet trade, would we have enough wool to supply the normal trade?

Mr. von Bergen: We will not have enough when the Army and Navy start going. During the last war, there were times when the peak here was over 500,000,000 pounds in foreign wools.

Chairman Zisman: What can you tell us as to the progress of substitutes for wool, the casein products, for example. What progress has been made in this country?

Mr. von Bergen: Up to now, from our mill standpoint, we don't care about the substitutes. All fibers such as the Lanital, the soy bean fiber, and so on, are not yet in competition with he wool fiber, because they are still too weak. Especially the wet strength is very low. I think they never will have the property which nature has given us in the wool fiber.

Mr. Herrmann: Supplementing our Chairman's question, with regard to the great influx of materials which are blends of wool in various artificial fibers, particularly the so-called cut staples, rayon, etc., I would like to ask, to satisfy my curiosity, whether this growth is due to economic necessity, to lack of raw material, or whether it is a price question of finished fabrics, or is it just due to the demand of the market for novelties and different weaves at low prices? We sometimes hear that these things are being forced on us because of a shortage of wool. One of the questions here seemed to bring out that we didn't have enough wool. Is that the real reason as to why these materials are coming in, or is it because the American market likes many new styles and continually lower prices?

Mr. von Bergen: Your last remark is more or less the correct answer. That was the start of the thing. The American market is very easily flooded with new styles. It likes a change. Therefore, when the first fabrics of this kind appeared in Paris, they were taken over like hot-cakes in this country—not of necessity, absolutely not; but just because of pure curiosity.

And today, naurally the inroads they had made went far enough to give some of the manufacturers tremendous price advantages. However, I think that is more or less all that they have gained, price advantages, but they have sacrificed quality.

MEETING, NEW YORK SECTION

THE second meeting of the New York Section was held at the Chemists' Club, New York, N. Y., on December 1st, 1939. The speaker was Mr. Werner von Bergen, Director of Research, Forstmann Woolen Co., Passaic, New Jersey. His subject was "Quality Control in a Woolen Mill" which proved to be most instructive.

L. S. Zisman, our Section chairman, and Henry Herrmann referred to the honor and obligations of this Section as hosts to the entire association during the coming convention which is to be held on October 18th and 19th in New York City.

P. J. Kennedy, general convention chairman, reported on the many plans now under way, but not yet completed, towards making the coming convention both interesting and valuable to the visiting delegates.

Total attendance was ninety-nine (99).

Respectfully submitted,

P. J. KENNEDY, *Secretary*.

MEETING, PHILADELPHIA SECTION

THE last meeting of the Philadelphia Section was held at the Penn Athletic Club on Friday, January 19th.

We had as our speaker Mr. Werner von Bergen of the Forstmann Woolen Company, whose subject was "Quality Control in a Woolen Mill." Mr. von Bergen illustrated his talk with slides.

The attendance for dinner was 120, while 137 members attended the meeting following the dinner.

Respectfully submitted,

P. J. CONAWAY, *Secretary*.

MEETING, PIEDMONT SECTION

THE winter meeting of the Piedmont Section was held at the Poinsett Hotel, Greenville, S. C., on February 10, 1940. Approximately one hundred and seventy members and their guests attended this meeting which is the largest attendance for this Section in the history of the organization.

A technical meeting was held in the afternoon with papers on "Textone," by G. P. Vincent, Mathieson Alkali Works, and "Semi-Resin Finishes for Cotton Piece Goods" by W. W. Trowel, Hercules Powder Co. A separate round table discussion was held for hosiery dyers and was led by H. Grady Miller, the subject being, "Problems Presented by the Use of Synthetic Fibers in Full Fashioned Hosiery."

The banquet was addressed by J. S. Long of Devoe & Reynolds Co., who made a very entertaining and instructive talk.

Both sessions were presided over by Mr. H. E. Kiefer, Chairman.

Respectfully submitted,

ROBERT D. SLOAN, *Secretary*.

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary or the American Dyestuff Reporter any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer; New York Viciniy. Age 33; married.

A-B-8

Education—Graduate Chemist.

Experience—Print superintendent, colorist; eleven years' experience in all types of fabrics, specializing on rayon; 8 years' dyestuff laboratory and demonstrating. Excellent references; age 37; married.

A-B-9

Education—Bradford Durfee Textile School, 1918, chemistry and dyeing course.

Experience—Dye application, textile and color chemist; good general factory, laboratory and office experience; accustomed to assuming responsibility; handled all types of help; purchased chemicals, dyes, etc.; executive ability; good personality.

Age 42; American, married; will go anywhere for interesting work; references.

A-B-10

Education—1 year of textile chemistry, day course, Philadelphia Textile School; also business course.

Experience—3 years as apprentice in weaving mill in Germany, office and stock room, general clerical work, practice in all departments of cotton manufacture, dyeing, bleaching and finishing of cotton-rayon mixtures, piece and package processing; several mos. in laboratory of German dyestuff manufacturer, dyestuffs and assistants and their application, vat and naphthol dyeing.

Age 20; will go anywhere in U. S.

A-B-11

Education: Graduate chemist. Correspond and converse German, some French.

Experience: 3 years dyer; 4 years dyestuff testing, trouble-shooting, purchasing; 4 years demonstrating, consulting, and supervising for large dyestuff manufacturer. Thoroughly experienced on rayon, cotton, silk, acetates, printing, vats. Fullest references as to character and ability. Seeks position as technician, consultant, or superintendent with reliable dyestuff sales organization or dyehouse. Age 33, married.

A-B-12

Education—Philadelphia Textile School (Evening), Chemistry and Dyeing, Quantitative and Qualitative Analysis.

Experience—Two years in yarn office, making wool stock blends. Last 6 years in dyehouse, 4 years as kettle hand, 2 years in piece dye work. Worked on yarn, raw stock and piece goods; has been dyer on union piece goods, cotton, rayon and wool, leaving wool white; also worked on all wool fabrics and woolen cross dyes; also considerable laboratory experience doing laboratory dyeings and extraction work. Seeks position as dyer or laboratory technician.

Age 30; married; references.

A-B-13

Education—B.S., Chemical Engineering, Oregon State College, 1926.

Experience—First experience in dry cleaning plant; few months as sampling and control chemist with potash and chemical company; two years in dry cleaning plant, all phases of work; few months on routine and special analyses, plant problems, special studies and research for gas and electric company; 10 years teaching experience on textile chemistry, dyeing and textile testing covering all general and special courses in this field; consultant work with various mills. Seeks position in textile chemistry or dyeing.

Age 37; married; will go anywhere; references.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-8

Education—B.T.C., 1933, Lowell Textile Institute.

Experience—5 months as rayon slasher tender; 8 months color matching, dye testing and analytical work; 5 years with large print works in rayon finishing department, laboratory, color matching, dye testing, assistant rayon dyer. Seeks position as rayon dyer, assistant dyer, or any job in a rayon dyeing and finishing plant. Age 29; single.

A-B-C-9

Education—Lowell Textile Institute; chemistry, dyeing and textile finishing.

Experience—Twelve years head dyer in hosiery mills. Dyeing all types of fibers and in combination. Knowledge of all dye applications. Matching and formula making. Charge of every department in a hosiery mill except fixing machinery. Has done jigg work on cottons and rayons. Desires position in hosiery, or in any field. Would like to work as an assistant to head dyer in a woolen or rayon mill. Age 42; married. Will go anywhere in the United States.

A-B-C-D-1

Education—Lowell Textile Institute, Bachelor of Textile Chemistry; Lowell Textile Institute (Evenings), 2 years D. C. Electricity; 2 years A. C. Electricity.

Experience—Six years as chemist and assistant dyer with a large organization. Specialized in dyeing, finishing, bleaching and drying of woolens, worsteds, cottons, rayons and unions in the piece. Some sales experience. Desires position as chemist, dyer, finisher, bleacher or sales. Age 30; American citizen; Married.

A-B-C-F-1

Education—Textile Institute course in Dyeing and Chemistry; Extension work at Brown University; Executive Training with Alexander Hamilton Institute of New York, N. Y.; working knowledge of one foreign language.

Experience—Dyeing executive on all types of textiles including stock, yarns in the skein, warp and package, and piece goods. Thorough knowledge of all classes of dyes and dyestuffs and their successful practical application in the plant. Extensive knowledge of all types and makes of equipment for dyeing, bleaching, mercerizing and finishing. Laboratory practice in testing, standardizing, purchasing, costing, planning and checking processes, and market analysis. Good manager of personnel for better efficiency in retaining friendly labor relations. Conversant with modern methods for quality production economically secured through better coordination and correct alignment in processing, on cotton, viscose and acetate rayon, silk, wool, worsted, and mixtures. In excellent mental and physical health; excellent references.

A-B-D-1

Education—Special courses in general chemistry.

Experience—Twenty-nine years' experience in application and standardization laboratories of various dyestuff manufacturers. Well versed in the application of dyestuffs to different textile fibers, i.e., wool, cotton, rayon, silk, acetate rayon and unions, using direct, acid, diazo, sulfur, acetate rayon, chrome and after-treated direct dyestuffs. Six months' actual dye house experience on jigs, open boxes, padders, bleaching and mercerizing. Experience demonstrating sulfur and direct colors at various mills. Seeks position as textile colorist in application laboratory and demonstrator.

Age 46; single; references.

A-D-1

Education—Graduate of New Bedford Textile School, 1936.

Experience—Chemist for woolen mill 7 months; technician and salesman for chemical company 1 year and 9 months. Seeks position as salesman or in purchasing department.

Will go anywhere; married; references.

B-5

Education—High School and Textile School Graduate.

Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Graduate New Bedford Textile School; also post graduate work in advanced microscopy and rayon testing.

Experience—Five weeks in color shop of print works. Wants position in anything associated with textile chemistry, dyeing, finishing and testing.

Single; age 21; references.

B-C-3

Education—Graduate, Philadelphia Textile School; speaks German fluently.

Experience—Employed at velvet company for 7½ years. Past 2 years working in finishing department on regular, waterproof and crush-resistant finishes (resin finishes). Can take charge of finishing of velvets. Have some piece dyeing experience.

29 years of age; married; will go anywhere.

B-D-1

Education—General education in England. Chemistry and Dyeing Courses at Huddersfield Technical School.

Experience—Has been a superintendent of dyeing since 1911. Has had experience in worsted mills, hosiery mills and woolen mills. Congenial, sober and reliable. Married; references; age 53.

F-1

Education—Two years high school; 6 years evening engineering school; 1 year evening textile school; 1 year industrial management; course in accounting.

Experience—Ten years in an executive capacity in full fashioned hosiery manufacturing business. Familiar with entire manufacturing procedure, finishing dept., dyehouse and office. Specialized in finishing dept. and has good eye for color, finish and quality. Had responsibility of all orders going through mill, stock, grey goods and traffic. Five months in New York sales office. Gets along well with people and contact with employees and customers has always been satisfactory. Previous to hosiery experience was in a mechanical business for 17 years.

43 years of age; single, in good health; will go anywhere.

Twentieth
ANNUAL MEETING AND CONVENTION
HOTEL COMMODORE
NEW YORK CITY
OCTOBER 18TH AND 19TH, 1940

General Chairman

PATRICK J. KENNEDY

RECEPTION COMMITTEE

J. Robert Bonnar
E. F. Ernst
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Auspices of

NEW YORK SECTION

Ler Man Studios

A. J. ROYCE
Chairman, Reception Committee

A. J. ROYCE, President and General Manager of the Royce Chemical Co., will be chairman of the Reception Committee for the twentieth annual meeting. The Royce Chemical Co. has offices in all the principal textile centers and this fact, together with Mr. Royce's activities in local and national affairs of the association, has made him particularly well known to the members. He was chairman of the Entertainment Committee for the fourteenth annual meeting held in New York in 1934 and has been chairman of the Outing Committee of the New York Section for the past few years. Mr. Royce will be ably assisted by the persons whose names appear at the left.

Colorcade

(Continued from page 82)

is used in the soda process and the alkali content kept constant with additions of soda-ash. In the sulfate process any alkali losses are replaced with sodium sulfate instead of carbonate. Ground-wood as the name implies is mechanically produced by pressing the properly sized logs against grindstones as a stream of water carries off the newly formed wood particles.

Following several conditioning washings the various pulps receive one further preparation in the engine or beater before finally becoming paper.

Much as the writer would like to go into the history of leather as fully as information at hand would permit, the subject is too broad to allow of so doing within the limits of this generalization of color. Hence, let's just pass lightly over the high points in leather manufacture and devote more space to the coloring of it.

In the Book of Genesis in the Old Testament may be found the words "Unto Adam also, and to his wife, did the Lord God make coats of skins, and clothed them."—As to the antiquity of the preservation of hides and skins, if the Original Writings have handed down correctly, nothing more need be said.

Following the removal of pelt from carcass, it is immediately treated to check putrefaction. Subsequent treatments are soaking, degreasing and dehairing prior to actual tanning. Tanning methods are numerous and involved. The important ones are vegetable, chrome, chamois or oil and alum tanning. Combination tannages in which two or more of these processes are united or together with formaldehyde also come into consideration. Synthetic tanning materials derived from coal-tar are in use with a fair degree of success.

The dyeing of leather is a rather interesting procedure although sometimes conducive to mild forms of headache. Variations in weight, texture and other conditions in succeeding lots of skins present difficulties not found in most other types of dyeing. In a general way, the methods of color application are about four in number, viz: drum, paddle, brush and tray. Drum dyeing is the principal method employed, particularly where penetration of color is sought, which, in fact, is only possible in the drum. Here the pounding created by the combined weights of water and skins forces into the innermost layers of the leather the dyestuffs which are carefully selected for the purpose. Only the heavier skins such as calf, horsehides, chrome sheep and goatskins are strong enough to withstand, successfully, the violent drum pounding. Lighter leathers are dyed in the paddle where a milder action is obtained. By tray dyeing, it is possible to color only the grain side by pairing the skins flesh to flesh and immersing in the dye solution at proper temperature until the desired depth of shade is obtained. This method is seldom used today because of its high cost and low production. Brush dyeing is used only on heavier and larger leathers such as cowhides for bags, harnesses and upholstery.

In my old College of Color, the Blue Works' laboratory, and the term is not entirely facetious, the problems in leather dyeing were all embracing. My teacher, John, was familiar with many of the established tricks of tanning and coloring and created a few himself. His equipment consisted of a home-made drum fashioned out of a small beer keg with a hollow axle or trudgeon through its center and a box-like contraption with compartments for six fruit jars. Until each earned the right to motors, the drum was turned by hand and the other piece of equipment was powered with a small gas engine. Many hundreds of shades were matched on all types of leather in those six fruit jars and when required, practical checks were run on full skins in the beer keg drum. My friend John was an able instructor on the subject of leather coloring and willingly dished it out as rapidly as his instruction could be absorbed. Let's view the results of his tutoring.

"When the chrome-tanned types of leather are under treatment it is important that the skins be thoroughly neutralized prior to application of color if levelness and penetration are to be had. The chrome tanning processes leave the leather in a rather strongly acid condition and although most of the surface acid may be removed with comparative ease, much of it still remains within the skin fibers and can only be disposed of by drumming in a mildly alkaline bath of borax, bicarbonate or ammonia. After the required drumming time, a cross-section of skin is cut and tested with a pH, litmus or other indicator paper. If desired, the dyestuff may then be directly introduced through the trudgeon and a further run given in the alkaline medium at the proper temperature before exhausting and fixing with additions of a mild acid such as formic or acetic.

"Of the synthetic dyestuffs, the acid colors are given first consideration for chrome leathers. Of almost equal importance are the direct colors and many of the chrome or alizarine group. For purposes of economy and fullness of shade, it is common practice to give the skins an initial bottoming with some vegetable coloring such as fustic, quebracho, gambier, sumac and especially in the case of blacks, hematine. These vegetable substances are then fixed with some suitable mineral salt like titanium-potassium-oxalate, a bichromate or even a copper or iron salt. The dyeing temperature is usually about 125° F. although chrome-tanned leathers may withstand tempera-

tures as high as 160° F. without serious results.

"In a broad sense, the same groups of colors and methods are applicable to the alum and alum-formaldehyde tannages. It is advisable, however, to guard against temperatures above 125° F.

"For garment suedes, glove leathers, etc., uniform and complete penetration of color is of utmost importance. Aided by thorough neutralization of the skins before dyeing, penetration may be acquired with properly selected dyestuffs, viz: very soluble and slow exhausting types. Some of these are—Alizarine Yellow 2G, Yellow RG, the Fast Light Yellows, Crystal Orange, Alizarine Orange 2RN, Amido Napthol Red G, Brilliant Red 5B, Chromaven Fast Red B and Acid Rhodamine. Also the Alkali Fast Greens, Wool Green S, Chrome Green S, Patent Blue V, Acid Brilliant Blue Conc., Cyanole FF, Violet BG and Anthracene Brown RHD. Of exceptional merit for penetration are Yellow RG, Acid Rhodamine and Cyanole FF. A peculiar characteristic of these three colors is their tendency to show more tinctorial value within the leather as observed on a cross-section of even the heaviest chrome calf, than is apparent on the surface. Employed alone they offer some difficulty as to control but in conjunction with the milling types of acid colors or the faster dyeing direct colors, these three 'graces of the corium' are of value when penetration is essential.

"Basic colors have no particular affinity for chrome tannages, but frequently, for purposes of shade fullness, brilliancy or for covering defective grains, a topping with them is given over acid, direct or chrome colors. To prevent spewing, the basic colors are necessarily applied from a fresh bath and rinsed thoroughly before fat-liquoring if such treatment is not applied prior to dyeing. Fat-liquors, incidentally, are emulsions of oils: castor, neatsfoot, sulfonated, etc., which, combined with certain fats, return to the leather some of those items of nourishment, pliancy and suppleness which were present in the skins before their original owners' enforced passage through the valley of shadows.

"Unlike the chrome tannages, the vegetable tanned leathers possess a strong and natural affinity for the basic colors although the acids, chromes and directs may be applied neutral or in a mildly acid medium. For the preservation of the leather, temperatures must not exceed 125° F., in fact, to insure even shades, temperatures below 100° F. are best employed where basics are concerned.

"Chamois, or oil-tanned skins usually find their way to market in an undyed state. However, when color is required they are necessarily mordanted with one of the bichromates or chrome alum prior to dyeing for which the acid, chrome and direct colors are used. Dyeing methods are much the same as for the chrome tannages."

During five years of association with John, a liberal education in leather was within grasp but only a sponge-like intelligence could have hoped to soak up all of it. When last I heard of him some few years ago, he was still in there tossing 'em up for the old home team. Paying tribute while pleasantly reminiscing is, perhaps, a form of emotional intoxication;—but then, it's a harmless sort of binge.

Sometimes when looking back across the years, familiar scenes present themselves. Some occasion happy thoughts; many do not. Some have dimmed with the passing years while others stand out sharp and clear. One such vivid scene presents itself here:—It is the noon hour at the old "Blue Works"; summer of 1914. In the picture can be seen several "Easter-Eggs." Two of them are hurrying back from the saloon just opposite those huge gates. Each grasps at his sides two broom handles in horizontal position from which, suspended in notches, are some cans of beer. A dozen "pints" for as many fellow workers with which to wash down as many otherwise dry lunches. Excitedly, both men talk at once as they rush back with confirming reports of war in their birthland across the sea.

This was the spark that ignited the world and beginning of the compelling force that created an adequate dyestuff industry in these United States. From this spot on, at least here at home, no red "STOP" signals appeared and after a short period of frenzied and confused profit taking, the pace of development went steadily forward.

Yes, the siege had begun; the siege that was to bring misery, death and destruction over there—fortune and luxuries, to some over here. Fortunes made out of anything that bore the slightest resemblance to dyestuff. Discarded materials, long regarded as valueless were brought forth and quickly snapped up by consumers for fancy prices.

Many of these easily gained fortunes collapsed of their own weight, as, easy come — easy go, they streamed through the proverbial knot-hole. But a greater, finer fortune, a fortune of stability and character was yet to come. Men of more serious purpose took the situation in hand and over the chaos they laid a firm foundation. Then, began the building of a chemical and color industry here at home which, as we now know, was so well founded as to obviate any possible repetition of those early World War day nightmares.

Our eventual participation in the European mess temporarily slowed progress; nevertheless, development went doggedly on. During the war a number of plants were erected and engaged in the manufacture of explosives. When finally in 1918, the armistice was signed, and there came an end to the need for materials of destruction, most of the equipments were easily applied to the peace time pursuit of dyes and intermediates manufacture. Within a few short years, dependence upon foreign sources seemed only like a bad dream.

Chance recently placed the writer in the company of a man prominent in our dye and chemical field as he paused a moment to reflect. His dynamic figure fairly oozed that indomitable spirit which stamps the pioneer as he discussed with an associate, an occurrence of the day. The occurrence and some mental arithmetic revealed the fact that the date marked also the anniversary of his entrance into the business of color as an importer and dealer. He recalled

with a grimace the uncertainty of those early war days which followed a few years later. Had this man elected to do so, he might also have recalled with pardonable pride, his own estimable contributions of creative force to the building of a new American industry.

The incident revived memories of the delirium which commenced with the outbreak of hostilities and the severance of European dye supplies. It brought back thoughts of socks and stockings, black before, but green after washing; of complaints from all sides of dyed skin after one wearing of colored apparel. Of even Uncle Sam's complaint that his postage stamps could not be properly colored.

It also brought to mind the joy that came to consumer and dealer alike when the German submarine Deutschland stole into port at Baltimore with a cargo of gold in the form of dyestuffs. And, too, the days of dizzy prices when such items as Rhodamine B Ex. sold for one hundred dollars per pound, and more.

Contrast all that with these excerpts from a 1940 news item: ". . . Since the textile industries account for three-fifths of dyestuffs consumption, they naturally are a sensitive index to activity (dyestuffs) in the dress goods and apparel lines. Swiss and German dyes continue to be imported, although non-competing. German dyes are carried in neutral ships. What effect the British blockade will have cannot be foretold. However, normal imports account for no more than 5 per cent of American dyestuffs consumption. American export volume exceeds the import." That news smacks of a healthy condition of our modern dyestuff industry.

Nomograms

for Various Plant and Laboratory Computations

LEONARD SHAPIRO*

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NOTE: The first portion of this article appeared in the January 8th issue.

VIII. Interconversion of Temperature Scales

The relationship between the Centigrade and Fahrenheit temperature scales is shown by the accompanying chart for the conversion:

$$°C = (°F - 32) \times \frac{5}{9}$$

IX. Interconversion of Barometric Units

The accompanying chart shows the relationship between the units commonly used in measuring barometric pressure. Barometric pressure is generally measured in inches or millimeters of mercury, but the metric unit of pressure, the millibar, has recently achieved prominence owing to its adoption by the U. S. Weather Bureau.

X. Units of Length—English vs. Metric

This nomogram is useful in converting English length units to Metric units or vice versa. Thus, to convert 30 inches to centimeters, it is only necessary to lay a straightedge from 30 on the left-hand scale through the appropriate cross-intersection to the right-hand scale, where we read 76.2 centimeters.

In cases where the straightedge fails to intersect both scales, it is necessary only to move the decimal-point until the number falls on the scale, and then to move the decimal-point in the answer back an equal number of places. Thus, to convert 70 miles to kilometers, we note that a line from 70 on the left-hand scale through the "Miles-Kilometers" intersection fails to meet the right-hand scale. Moving the decimal to the left, we lay the straightedge from 7 on the left-hand scale through the "Miles-Kilometers" point, and we read 11.0 on the right-hand scale. Moving the decimal back one place to the right, we obtain 110 kilometers.

XI. Units of Volume—English vs. Metric

This nomogram simplifies the conversion of English volume units to Metric units (or vice versa), and its use is similar to that of the preceding one. In some cases, as indicated on the chart, the reading of the metric unit scale should be multiplied or divided by 10.

Thus, suppose we wish to convert 32 fluid ounces to milliliters. We set our straightedge from 32 on the left-hand scale through the "Fluid Ounces-Milliliters" point, and we read 94.6 on the right-hand scale. Since the scale reading must be multiplied by 10, this becomes 946 ml.

(In converting from Metric Units to English units, instead of multiplying the Metric reading by 10 as indicated, we may divide the answer on the English scale by 10.)

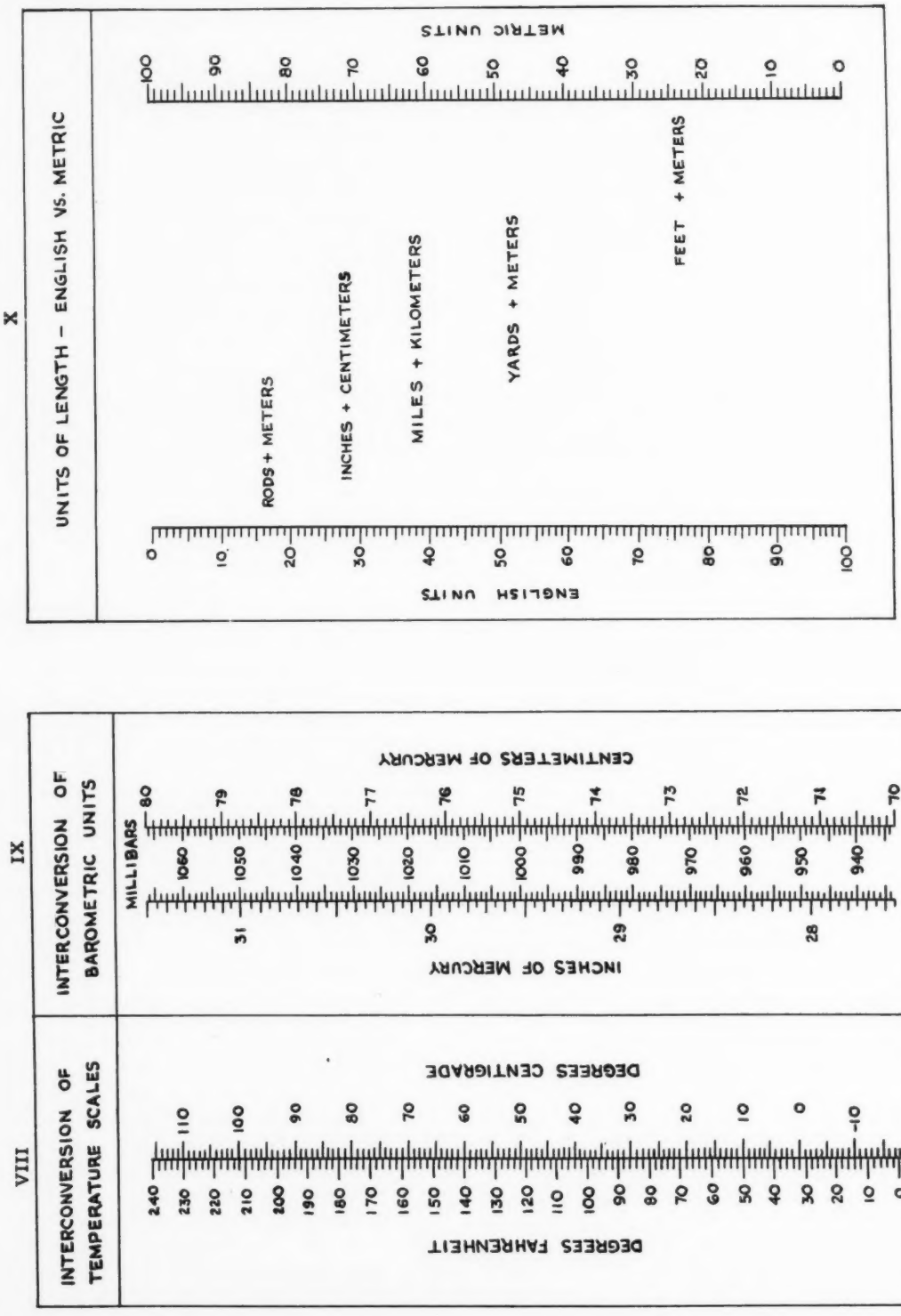
XII. Units of Weight—English vs. Metric

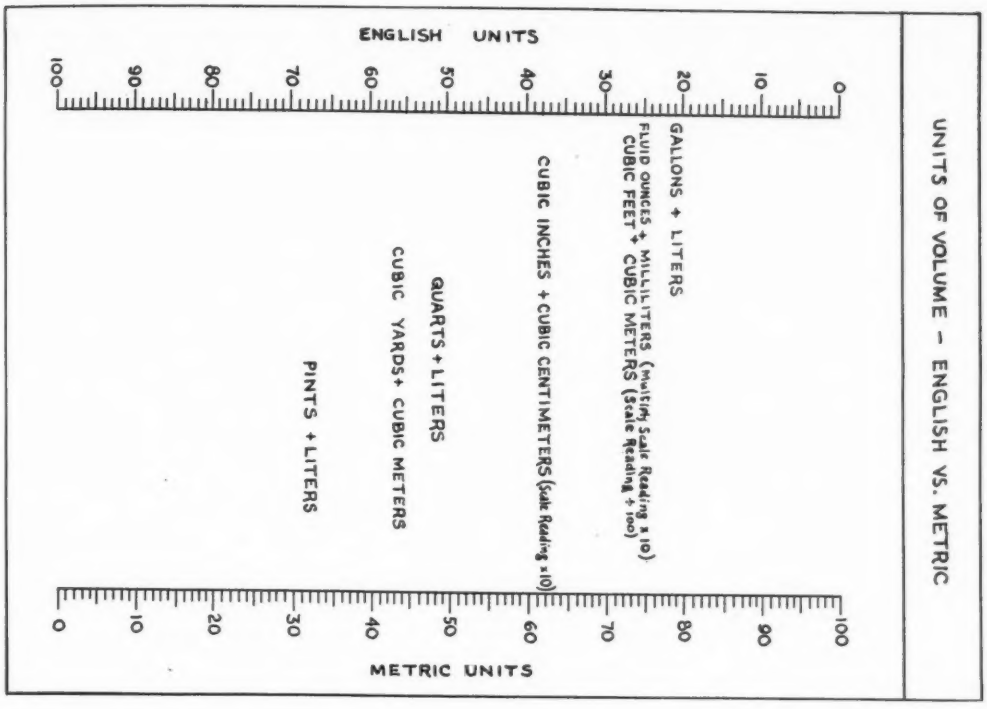
The use of this chart is similar to the preceding one. In the three cases indicated, the metric scale readings must be multiplied or divided by ten. In converting from

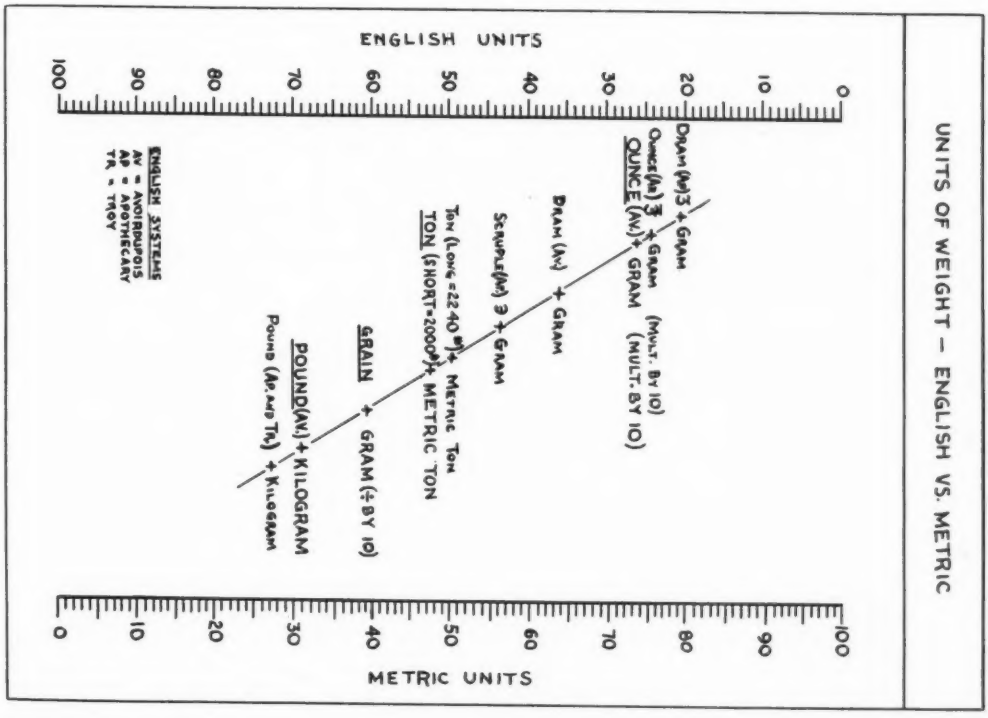
*Director of Laboratories, Interlaken Mills.

the Metric to the English system, the reverse procedure is used. Thus, if we wish to convert 32 grams to grains, we extend a straightedge from 32 on the right-hand scale through the "Gram-Grain" point to 49.5 on the left-hand scale. *Multiplying* this value by 10, we obtain 495 grains.

The more commonly used English units (Avoirdupois) are underlined for convenience in distinguishing them from the less-frequently used units (Apothecary and Troy).


X
UNITS OF LENGTH – ENGLISH VS. METRIC
METRIC UNITS
0 10 20 30 40 50 60 70 80 90 100
ENGLISH UNITS
0 10 20 30 40 50 60 70 80 90 100
RODS + METERS
INCHES + CENTIMETERS
MILES + KILOMETERS
YARDS + METERS
FEET + METERS
IX
INTERCONVERSION OF BAROMETRIC UNITS
CENTIMETERS OF MERCURY
80 79 78 77 76 75 74 73 72 71 70
MILLIBARS
1060 1050 1040 1030 1020 1010 1000 990 980 970 960 950 940
INCHES OF MERCURY
31 30 29 28
VIII
INTERCONVERSION OF TEMPERATURE SCALES
DEGREES CENTIGRADE
110 100 90 80 70 60 50 40 30 20 10 0 -10
DEGREES FAHRENHEIT
240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0


XI
UNITS OF VOLUME – ENGLISH VS. METRIC
ENGLISH UNITS
0
10
20
30
40
50
60
70
80
90
100
GALLONS + LITERS
FLUID OUNCES + MILLILITERS (Multiply Scale Reading x 10)
CUBIC FEET + CUBIC METERS (Scale Reading ÷ 100)
CUBIC INCHES + CUBIC CENTIMETERS (Scale Reading x 10)
QUARTS + LITERS
CUBIC YARDS + CUBIC METERS
PINTS + LITERS
METRIC UNITS


XII
UNITS OF WEIGHT – ENGLISH VS. METRIC
ENGLISH UNITS
0
10
20
30
40
50
60
70
80
90
100
DRAM (Ap)3 + GRAM
OUNCE (Av) + GRAM (MULT. BY 10)
DRAM (Av) + GRAM
SCRUPLE (Ap) ℈ + GRAM
TON (LONG = 2240 #) + METRIC TON
TON (SHORT = 2000#) + METRIC TON
GRAIN + GRAM (÷ BY 10)
POUND (Av) + KILOGRAM
POUND (Ap. AND Tr.) + KILOGRAM
ENGLISH SYSTEMS
AV = AVOIRDUPOIS
AP = APOTHECARY
TR = TROY
METRIC UNITS

TRADE NOTES • NEW PRODUCTS

• ONYX RELEASE

Onyx Oil & Chemical Co., Jersey City, New Jersey, has recently published a booklet entitled "The Xynomines." The Xynomines may be classified chemically as sulfated boro amide esters of alkyl compounds containing between twelve and eighteen carbon atoms. The oil soluble forces (hydrophobe) have been optimally balanced against the water soluble forces (hydrophile). Of interest is the foreword, which follows:

"No phase of textile chemistry possesses greater interest to the dyer and textile technician than surface activity and the functions of surface active substances. It is to these substances that detergency, dye levelling and penetration, wetting and emulsification largely depend.

"The explanation of the phenomenon of surface activity is involved and the mechanism by which surface-active substances function is not clearly understood. Most textbooks on physics and practical chemistry content themselves with a mere explanatory description of the subject and various phases of it. Even though the scientific explanation is not as yet entirely satisfactory, scientific methods of estimating the various factors involving surface activity have been developed and serve as useful tools in applying surface-active substances to industrial applications.

"A close parallel exists between the action of surface-active chemicals in solution and the action of mineral and lubricating oils on metallic surfaces."

The booklet continues with a discussion of the comparison between lubricating oils and surface-active substances. There follows a general description of the properties of the Xynomines and their uses in textile wet processing. Among the Xynomines which are discussed are the following: Xynomine Powder—an anhydrous general utility textile auxiliary; Xynomine Paste—an aqueous paste formulated to promote easier solubility; Xynomine SF—a salt-free paste particularly developed for dry cleaning and for those industries in which the presence of mineral salts is objectionable; Xynomine BM — a "phospho ester of Xynomine" particularly serviceable for scouring and water softening purposes; Xynomine Degum—a preparation buffed with alkalies to a pH of 10.2 so as to yield an optimal detergent agent. There are a number of tables, graphs and other illustrations.

Copies of the booklet are available upon request.

• CIBA REVIEW

Ciba Review, Number 29, for January, 1940, has recently been published. Featured in this issue is the subject of "Venetian Silks." Articles carrying out this theme are described by the following titles: Venice between East and West; The Venetian Silk Industry; Silk Fabrics in Venetian Paintings; Venetian Silks in the Art of the Import Countries; Historical Gleanings. As usual there are many interesting illustrations.

• QUAKER RELEASES

Quaker Chemical Products Corp., Conshohocken, Pa., announces release of the following new synthetic resins:

Diapene OA-50—which is said to provide a full-bodied, firm drapy handle.

Diapene O-33—which is said to impart a full, but very soft finish. It is often used in combination with Diapene OA-50 to modify the firmness of the latter.

The above are said to be now in regular use on acetate rayons, spun rayons, rayon-silk and rayon-cotton fabrics.

Diapene E-60—a resin used in starch finishing and backfilling which is said to provide softness and adhesion; to give a non-dusting finish; and to promote brighter colors.

• HEADS MARKET RESEARCH

Well known throughout the chemical and allied fields, Richard L. Davies has been appointed manager of the newly established Market Research Department of the Pennsylvania Salt Manufacturing Company, according to an announcement by Leonard T. Beale, President.

Mr. Davies is known to many in the chemical and allied industries through his sales development work on various Pennsylvania Salt chemicals, as well as through his chemical manufacturing and usage patents, and for his contributions to trade and technical publications.

The new department is organized to make studies of the market for products now manufactured by Pennsylvania Salt, or products under contemplation; to launch the sale of new products in line with sales and management policies, and to suggest to the management what should be considered for future production and sale both in the heavy chemical and specialty departments.

Market trends and opportunities will likewise be presented to the management for formulation of production and sales policies.

Mr. Davies' headquarters will be at the Executive Offices of the Company in Philadelphia.

• NOPCO PRESIDENT RESIGNS

The resignation of John H. Barton, president of the National Oil Products Co., Harrison, N. J., was announced recently by Charles P. Gulick, chairman of the board. Mr. Barton's resignation, effective March 1st, was received at the regular monthly directors' meeting. Election of officers and directors will be held at the annual board meeting March 4th.

Mr. Barton started with NOPCO twenty years ago as a salesman. Before his election to the presidency in June, 1938, he held numerous other executive posts including sales manager of the Farm Seed Division and vice-president-in-charge of the Plant Construction and Maintenance. His future plans are indefinite.

Mr. Barton lives in South Orange, N. J., and runs a large farm in Flemington, N. J. This farm has been in his family for 300 years.

• NEW TEXTILE BUILDING

The new Textile building at North Carolina State College has now been completed, the excellent equipment formerly housed in Tompkins Hall has all been transferred to it, and regular classes are being held in the new structure.

The building is four stories high, of fireproof construction, contains about 70,000 square feet of floor space, and cost approximately $300,000.00

Approximately $50,000.00 has been spent to supplement the excellent equipment which the Textile School already had. A complete woolen unit made by Davis & Furber has been installed in the woolen department. A new five-cylinder slasher made by Cocker Machine and Foundry Company, has been placed in operation and will be used by the Textile School and United States Institute of Textile Research for their cooperative research project on the warp sizing of spun rayon and spun rayon combination yarns.

The new building contains a cork insulated, air conditioned testing laboratory for research on yarns and fabrics. The equipment in this laboratory consists of autographic power yarn and cloth testing machines, single strand tester, Mullen tester, conditioning oven and other apparatus necessary for tensile strength tests and research. Another research laboratory has been provided for the Dyeing Department so that chemical tests on starches, oils, etc. can be conducted. The research equipment in this Department includes microscopes, photo-micrographic cameras and projector, Fadeometer, pH apparatus, as well as the analytical equipment generally used by textile chemists and a dark room fully equipped for photographic work.

• DU PONT RELEASES

The following new products have recently been released by E. I. duPont de

Nemours & Co., Wilmington, Delaware:

"Pontachrome" Orange RL—a new chrome color. It is said to possess very good fastness to light and for that reason will be of primary interest as a shading color to produce mode shades on automotive upholstery, uniform cloth and other fabrics requiring the best possible light fastness. The color is further said to be very fast to carbonizing, a desirable characteristic in a chrome color. Steaming, perspiration, washing and fulling have very little, if any, effect upon the shade, according to the company.

"Avitex" L—a new textile softener, said to possess high lubricating properties and essentially complete rinsability from textile fibers. It is a viscous, brownish, oil-like product which disperses to form clear type emulsions in water. It is soluble in the presence of high concentrations of salts such as common salt, Glauber's salt and Epsom salt and is said to be resistant to high degrees of hardness in water. It is highly stable in solution on prolonged boiling. "Avitex" L is recommended by the company for use where a well lubricated finish is required on fabrics or yarns. It increases the absorbency of textile fibers, making it effective for finishing fabrics to be Sanforized and it has a pronounced anti-static effect on staple viscose fibers, according to the company.

"Duponol" G—a new alcohol sulfate emulsifying agent derived from lauryl alcohol. It is a translucent amber colored paste to be added to the oil phase for preparation of emulsions. "Duponol" is particularly effective when employed in conjunction with "Ocenol" or "Stenol." It forms limpid solutions with mineral and vegetable oils in the presence of "soluble" oils, according to the company.

• NEW DYEING MACHINE CATALOG

The Rodney Hunt Machine Company of Orange, Massachusetts has recently issued a New Catalog No. 539 covering its line of "Tru-Shade" Stainless Steel Dyeing Machines. The catalog features the patented "Curve-of-Strength" type of construction developed by the Rodney Hunt Company, the sides of the dye tubs being curved to a "natural bulge" to withstand pressure of dye liquors from within. The company claims this improvement makes a stronger, more permanent machine at no additional cost. The catalog illustrates and describes a wide range of sizes and types of stainless steel dyeing machines from small sample units to the "largest dyeing machine ever built."

• PHOENIX RELEASE

Phoenix Color & Chemical Co., Inc., Paterson, New Jersey, announces release of the following:

Benzaphen Garnet B—a new and improved product. It is a direct garnet on cotton, rayon, etc., said to be bluer than the general run of prototypes. It is stated that a greater range of bordeaux and rubine shades can be obtained.

• NEW POSSIBILITIES WITH PIGMENT PRINTING

Beautiful color reproduction work comparable to that seen in fine magazines like *Fortune* may soon be possible in textile printing, according to Henry Young, Aridye Corporation, who spoke January 30th before 120 members of the Textile Square Club, meeting at the Wool Club, New York City.

Mr. Young discussed the latest developments in printing textiles with pigmented emulsions. "Pigment printing gives the designer new horizons," he said. "It has added new colors to his palette, and now he can put to use a printing medium which reduces the limitations which have bound him in the past."

"Eventually," said the speaker, "the designer will create a new style—a style based on the broad scope which pigment printing is introducing to the textile field. The sharp definition which this method makes possible, and its range of color, makes it entirely conceivable that color reproductions on cloth will have no more restrictions than do color reproductions in our finest paper-printed publications."

Mr. Young pointed out that he did not mean to indicate that there would necessarily be any relation between the design subjects for textile and paper printing. "But the new possibilities which pigment printing is creating mean that the textile designer can use fine shadings, photographic effects, and unusual color combinations almost as if he were to reproduce these patterns on paper, rather than textiles," said Mr. Young.

The speaker showed examples of the results already being obtained with pigment printing in achieving photographic and color effects. This is made possible, he said, by the extreme sharpness of impression which characterizes this method. Photographic subjects showing the World's Fair were used widely during 1939, and now other scenes, including a Hawaiian group, are popular on beach coats, housecoats, pajamas, and similar items.

"These photographic effects call attention to the new design opportunities in the shirting field. Up to now," he said, "printed patterns for shirtings have been largely imitations of woven designs. With the new vistas which pigment printing may open up, printed shirts will no longer follow the design trends of woven materials. Instead, they will forge ahead with new and spectacular designs of their own, and eventually, this will go far in eliminating the low-price stigma which is often associated with printed shirts.

"In addition to these new design possibilities, pigment printing is introducing new standards of light fastness to the textile field. Fabrics printed by this method have met amply the requirements of resistance to washing and rubbing set up by the National Association of Textile Finishers, and their light fastness considerably exceeds the standard ratings established recently by the Association.

Mr. Young said that his remarks covered only a few phases of the opportunities in printing with pigment pastes. "The development has come a long way in a short time," he said. "If it continues at like pace, it may eventually have a far-reaching effect on designs, materials, methods, and machinery for textile printing."

• NOPCO CAMERA CLUB

A Camera Club composed of employes of the National Oil Products Co., Harrison, N. J., has been organized and recently held its first exhibition. Winners were William Nothum and Earnest Segesseman, both research chemists. Mr. Nothum, president of the club, submitted a picture of an air liner in full flight while Mr. Segesseman showed a candid shot of a chipmunk perched atop a knapsack.

• MONSANTO EXPANSION

Monsanto Chemical Company invested approximately $4,200,000 in 1939 for expansion and improvement of its manufacturing facilities in eight American communities and anticipates an expenditure of a larger sum for such purposes in 1940, Charles Belknap, executive vice-president, said recently.

Principal points at which construction was carried on included St. Louis, Monsanto, Illinois; Anniston, Alabama; Monsanto, Tennessee; Springfield, Massachusetts; Everett, Massachusetts; Nitro, West Virginia, and Norfolk, Virginia.

The construction investment was in line with the company's normal policy of constantly improving its plants and processes, Mr. Belknap said.

• FEBRUARY TEXTILE RESEARCH

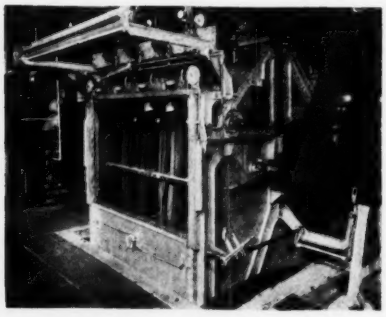
Another step in the research on the recovery and disposal of textile mill wastes, conducted under the direction of Dr. F. K. Cameron at the University of North Carolina, and financed by the Textile Foundation, is described in the February issue of *Textile Research* under the title "The Influence of Electrolytes on the Ballo-Electric Effect." It is a progress report of a highly scientific character, but should be found of vital interest by physicists and chemists specializing on this subject.

Of more practical importance to textile technicians and researchers is the index of articles and abstracts published in Vol. IX of this magazine which is a supplement of the February issue. Some idea of the comprehensiveness of this index of technical and research articles published through-

out the world during the year covered by Vol. IX, and of its value to those desiring to keep up to date in this connection, may be gained from the fact that more than 750 subjects are indexed, with a cross-index coverage of over 1,000.

• STAINLESS FULLING MILL

Riggs and Lombard, Inc., Lowell, Mass., report that initial installations of a new 4-roll stainless fulling mill have proven successful. The machine is really four fulling mills in one, since it can handle four different fabrics with different fulling requirements at the same time. It is suitable for fabrics such as worsteds, where reduction in loading time is important, due to the short period that they are in the mill.



The four separate bottom rolls are on one continuous shaft, while each top roll has a separate pneumatic pressure device. Separate guides are provided for each fabric and pressure in each packing box is independently adjustable.

All parts contacting the cloth are stainless metal.

• SPUN RAYON SIZING RESEARCH

The tentative appointment of F. Gordon Cobb as director of the research on the warp sizing of spun rayon and blends of cotton-spun rayon, to be conducted at North Carolina State College Textile School under the auspices of U. S. Institute for Textile Research, is announced by Carl R. Harris, chairman of the Administrative Committee for the study and manufacturing engineer, Erwin Cotton Mills Co. The appointment is "tentative" pending completion of the financing of this co-operative research, but as the fund is nearly subscribed the Committee is proceeding with plans to start active work.

Mr. Cobb started his career in cotton manufacturing as an apprentice erector of Draper automatic looms in the South; was an overseer of weaving at 19, then successively superintendent of F. W. Poe Mfg. Co., Greenville, S. C., Inman (S. C.) Mills, and in 1919 the Springs Cotton Mills, Lancaster, S. C. He was with the latter for 16 years advancing to general manager, vice-president and director, then retiring from active mill work excepting for some 18 months spent as vice-president in revamping Pomona Mills, Inc., Greensboro, N. C. Since then he has kept in touch with the industry as Market Counselor and textile consultant with *Cotton*. He is a life member of the Southern Textile Association and has served this body as president and executive secretary, also receiving its S. B. Alexander gold medal in 1926 "for greatest service to the southern textile industry" in that year.

Mr. Cobb brings to his new duties a broad practical knowledge of the subject to be investigated, the executive ability to direct the work toward its objectives without a waste of time and effort on unnecessary fundamentals, and has associated with him in an advisory capacity a group of scientists and practical manufacturers. As a manufacturer he was noted for his knowledge of warp sizing materials and methods. When most mills were making their own size mixtures he collaborated with two firms in perfecting sizing formulas that are still widely used. When the late Dr. Cathcart was engaged in developing thin-boiling starches the practical tests were conducted by Mr. Cobb.

Open Conference on Warp Sizing Research

A meeting of subscribers who have made this research possible by their co-operative financing will be held at the Textile School in Raleigh in the near future at which the Administrative Committee and director will report on their plans for the research, and at which the subscribers will have an opportunity to revise the research program and to see the laboratory and equipment for the study. While all progress reports and findings of this research are confidential to the subscribers for a year after they have been received by the latter, this meeting will be open to all who are interested in the subject of the research and may desire to learn at first hand of its objectives and the plans to attain them.

For program and free reservation those non-subscribers desiring to attend this open conference should address Mr. Thomas Nelson, Dean, Textile School, N. C. State College, Raleigh, N. C., or C. H. Clark, Secretary, U. S. Institute for Textile Research, Inc., 65 Franklin St., Boston, Mass.

• CLASSIFIED ADVERTISEMENTS •

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED: Specialized hosiery dyer at present employed. Eight years' experience on silk, silk mixed and rayon. Very dependable and capable of taking full charge. Age 30. Excellent health. Write Box No. 229, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: An experienced dyestuff salesman to cover New York City and State. Give full details of previous experience and connections. Replies confidential. Write Box No. 230, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Dyer with many years' practical work in responsible position in dyeing of silk, rayon and acetate. Able to take full charge or supervise all operations of dyeing; laboratory praxis, expert in dyeing of fast colors. Best references; desires responsible position. Will go anywhere. Write Box No. 231, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

SALESMEN WANTED: A sales opportunity presents itself for three men in the South as well as Pennsylvania and New York. Experienced men or young men who would like to join the sales staff of a growing organization should be interested. The company inserting this advertisement is well known and are manufacturers of dyestuffs. Correspondence will be strictly confidential. Write Box No. 232, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.